FLIGHT
and The AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

Editor
C. M. POULSEN

Managing Editor
G. GEOFFREY SMITH

Chief Photographer
JOHN YOXALL

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1

Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (35 lines).

8-10, CORPORATION ST., COVENTRY. Telegrams: Autocar Coventry. Telephone: Coventry 5210.

GUILDHALL BUILDINGS, NAVIGATION ST., BIRMINGHAM, 2. Telegrams: Autopress, Birmingham. Telephone: Midland 2971 (5 lines).

260, DEANSGATE, MANCHESTER, 3. Telegrams: Iliffe, Manchester. Telephone: Blackfriars 4412.

268, RENFIELD ST., GLASGOW, C.2. Telegrams: Iliffe, Glasgow. Telephone: Central 4857.

SUBSCRIPTION RATES: Home and Abroad: Year, £2 8 0. 6 months, £1 4 0. 3 months, 12s. 0d.

Registered at the G.P.O. as a Newspaper.

No. 1664. Vol. XXXVIII. NOVEMBER 14, 1940 Thursdays, Price 9d.

The Outlook

Blows for Victory

WE may have a long and winding trail to follow before we reach the happy day of victory, which it is the set purpose of the British Empire and its allies to reach, but it is none the less cheering to fasten our minds occasionally on that future day. The problem which the ordinary citizen cannot solve is: How that victory will be brought to pass.

Mr. Eden, the War Minister, has said that the final blow must be struck by the British Army, and several eminent generals have said the same thing. Capt. Norman Macmillan wrote, in a recent issue of *Flight*: "I do not believe the Generals who tell us that the Army must strike the last blow," and he has been expounding his theory that the Bomber Command can bring victory to the British cause. It is therefore interesting to find an Admiral of the Fleet agreeing with the War Minister and the Generals. Lord Chatfield, who has been Minister for the Co-ordination of Defence, wrote the other day to the *Daily Telegraph*, and the following passages occurred in his letter: "Our immediate task is, therefore, to give our utmost effort towards building up our Air Force to strike the German industries such continuous, crippling blows that the German ability to fight for a long period will be so reduced as to make the German citizen lose hope.

"Nevertheless, we may not, even so, achieve our objective of a rapid victory, and the longer the war lasts the more certain it will be that land forces will be essential for ultimate victory, quite apart from our imperial dangers now."

In the history of warfare many new weapons have from time to time been introduced. Almost invariably the inventors and their friends claimed immediate victory as the result of their discoveries. The latest weapon is the aeroplane, and a similar claim is made for it by its extreme partisans. If the bomber by itself, or even in collaboration with sea power, defeats Germany, then a new chapter will have been opened.

The Prime Minister's Strategy

SINCE Lord Chatfield wrote his letter, the Prime Minister has expressed some of his views. Not only has Mr. Churchill inherited much of the ability of his great ancestor, the first Duke of Marlborough, but he is himself a very earnest student of strategy. In the course of his speech on November 5 he made public some of his ideas on how the British victory would be won. "Superiority in the air is the indispensable precursor of victory"; "Although the sea and air will be the main elements of the war effort of the British Empire, we must have a strong Army . . . capable of intervening . . . in the liberation of one or the other of the many countries which are yearning to throw off the odious Nazi yoke."

In these words one sees no leaning towards the idea of victory by one arm alone. Mr. Churchill speaks in terms of all three Services playing their due part in combination with each other. That is sound strategical doctrine as developed throughout ages of warfare. It will be noted that it departs from the British strategy of 1914-18, which included the use of a huge British Army on the Continent of Europe. Now the Prime Minister does not contemplate a huge Army. He spoke of "what it lacks in numbers compared with the Nazi or Fascist hosts." He spoke, too, of sea power giving the Army a wide choice of action, and of our regaining the initiative and making the enemy wonder where and how we are going to strike at them. All these expressions give a clue to the general outline of the plan which is working in the mind of the Prime Minister.

Yet nobody could accuse him of lack of appreciation

of air power. Superiority there is the indispensable precursor; our main effort will be on the sea and in the air. The Army, small by comparison but of the highest quality, will strike the final blow when the Navy and the Air Force have prepared the way. The whole conception is convincing.

Provocative P.-B.

ONE may disagree with Mr. Pemberton-Billing (most people do most of the time); one may be very fond of him (most people are most of the time); one may dislike him (a few people do now and again); but one can never be indifferent to him. We on *Flight* have known "P-B" since about 1912, and we have disagreed heartily with him on a great many occasions. There have even been times when we thought we disliked him, but those periods did not usually last very long.

Just now we are intensely intrigued by his scheme for meeting the long-range bomber specification asked for by Captain Macmillan in a recent article. We have been guilty of acting the rôle of *agent provocateur* because, by throwing some doubt on the possibility of fulfilling Captain Macmillan's demand, we knew that "P-B" would rise to the bait. He has done so to some tune, and the first result is published this week. Whether or not the full story can be told next week rests with the Air Ministry.

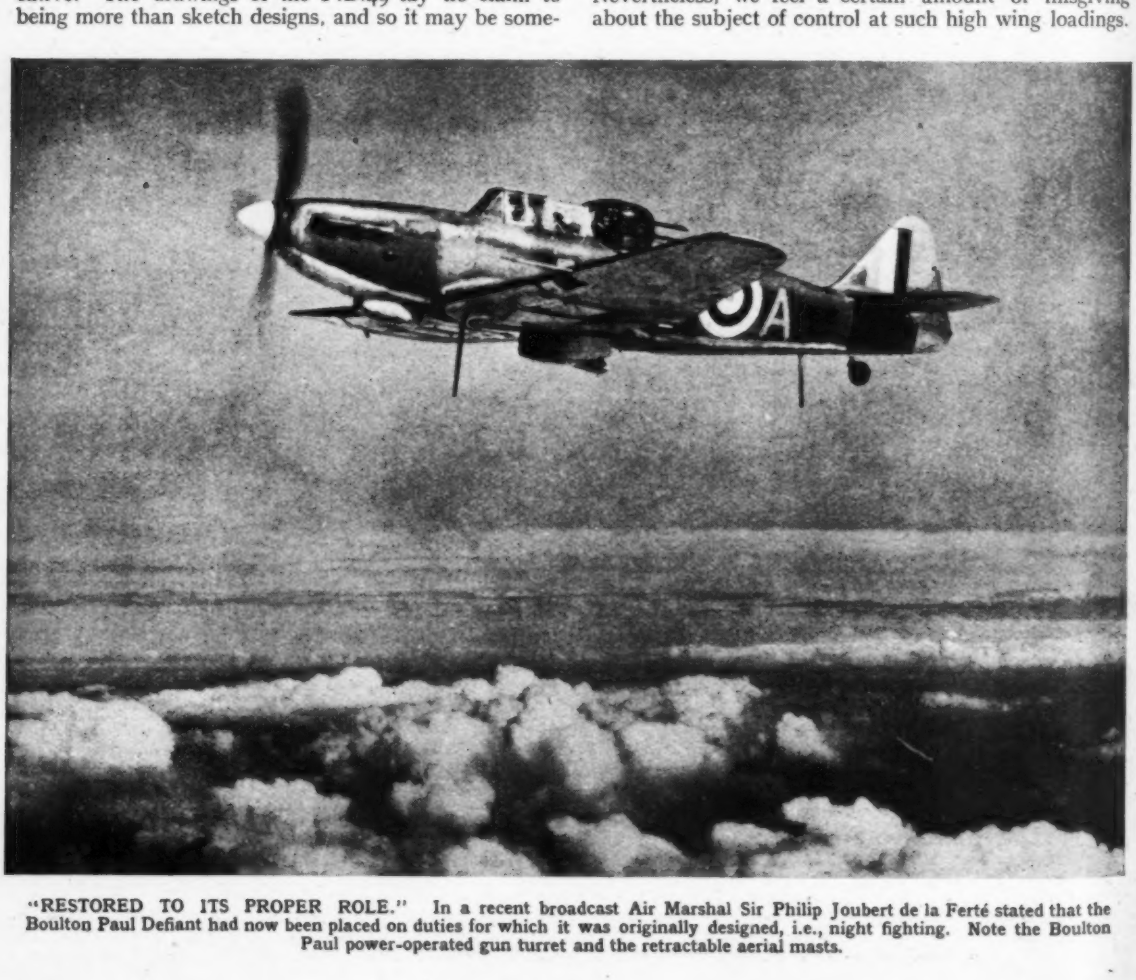
In the meantime, the first article is sufficiently provocative. The drawings of the P.B.49 lay no claim to being more than sketch designs, and so it may be somewhat unfair to criticise details. But one does form the impression that the load distribution is likely to cause trouble. The engines are fairly far aft, and one would imagine that when the bombs have been dropped and the fuel consumed, the machine would be unpleasantly tail-heavy.

Of the performance figures quoted we need not, perhaps, say very much. They have, we are informed, been checked and re-checked by competent technicians, but we cannot resist the temptation to point out that the apparent "cleanness" of the design would be somewhat marred by the, at present invisible, glycol radiators.

Wing Loading and Control

WHAT is more important is the problem of control at speeds of more than 400 m.p.h. and wing loadings of 98 lb./sq. ft. Most modern single-seater fighters (although there *are* exceptions) suffer from the disability that at the higher speeds the controls become "hard," and in some they are almost "solid" at short-period top speed. Yet the wing loadings are considerably less than half of that contemplated for the P.B.49.

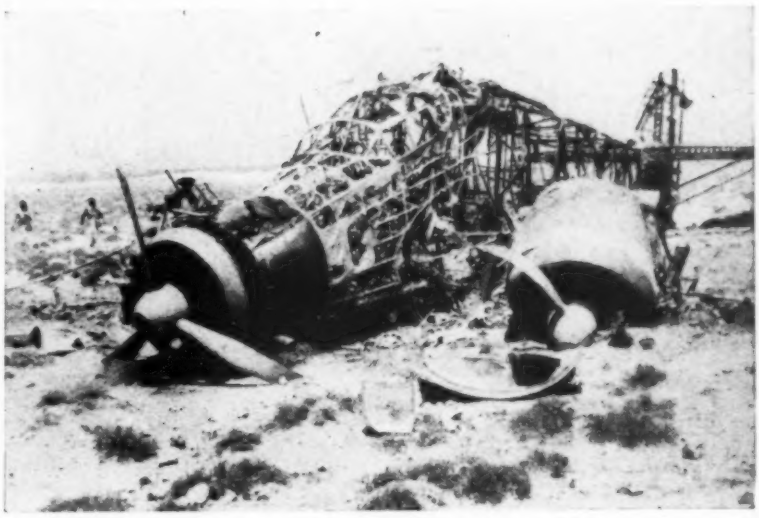
Mr. Pemberton-Billing will probably argue that as his machine does not require manœuvrability it will not matter if it is heavy on the controls, and that the fact that *some* fighters do not exhibit this unpleasant characteristic proves that the control problem *can* be solved. Nevertheless, we feel a certain amount of misgiving about the subject of control at such high wing loadings.



"RESTORED TO ITS PROPER ROLE." In a recent broadcast Air Marshal Sir Philip Joubert de la Ferté stated that the Boulton Paul Defiant had now been placed on duties for which it was originally designed, i.e., night fighting. Note the Boulton Paul power-operated gun turret and the retractable aerial masts.

WAR in the AIR

The Fighting in Greece : British Raids on Naples : An Air Fight in the Desert



DESERT DESERTS : The remains of a Savoia Marchetti S 79 bomber shot down in the Western Desert.

THE spirited manner in which the Greek forces have taken the initiative in attacking the invading Italian troops is the most interesting feature of the war at the present time. In particular the tiny Greek air arm has shown an offensive spirit at which one can only marvel. Greek bombers, presumably Blenheims, have bombed aerodromes at Koritza and Argyrokastro and are claimed to have destroyed several enemy aircraft on the ground, and they have also dropped bombs on Italian batteries and concentrations of other troops. The Greek fighters, Gladiators we hope, have also been active, and on Nov. 2 they shot down four enemy bombers, though losing two machines themselves. On the following Wednesday the Greeks bombed and machine-gunned Italian columns on the march from a low altitude, while their fighters shot down another Italian, and probably a second also. The weather was bad on the next day, but the Greek pilots did not let that deter them, and seem to have asserted a local air superiority on one section of the front. These were all small operations, but they showed the right spirit. If a very small force of bombers and fighters will tackle larger numbers of opponents in this way, there is every hope for more concrete results when the tide begins to turn.

Naples Raided Again

IN the meantime the British have wasted no time in taking steps to help their gallant little Ally. In our last issue we recorded the first British air attack on military targets in Naples. A second attack on that city was made on the night of Sunday, Nov. 3. Both these raids were carried out by machines of the Bomber Command, not by those of the Middle East Command. The type used and their itinerary has not yet been published. The following is an account of the Sunday night's raid.

Weather conditions were variable, but over Naples itself the crews were able to "pin-point" the targets without great difficulty. The attack lasted three quarters of an hour. The first aircraft concentrated on the oil refinery and groups of storage tanks at Poggioreale, on the southern outskirts of the city. Heavy bombs were dropped and many explosions were followed by fires. Opposition from ground defences was slight and ineffective. The second raid was on the station and railway junction in Naples. In this attack some of our machines were flying over the city at a height of less than 2,000 feet. In the third attack anti-aircraft batteries and searchlights were attacked. One battery was silenced effectively. One of the flight leaders engaged in this raid said on return home to his base: "I think this was the most interesting raid I have been on. The idea of competing with a volcano appealed to all of us. It was great to be in the first aircraft of the Royal Air Force in action over Southern Italy. As we came in from the north we could see the island of Ischia away to starboard and the rising bulk of Vesuvius behind the city. We made several runs to make sure we were dead on our targets before unloading the bombs. I bet we gave the Neapolitans a real shake up." All the British bombers returned safely.

On the next night, however, the Middle East took over the attack on objectives in Naples, a Cairo communiqué stating that on the night of November 4-5 military targets in that city were raided. The results could not be observed clearly, but a line of bombs exploded near the railway junction. All the British aircraft again returned safely.

In addition, a British naval and air base has been established in the island of Crete. That island is not unknown to officials of the late Imperial Airways. A British force there must have a very hampering effect on Italian communications with the Dodecanese islands, which are particularly dependent on supplies from the Italian mainland, some of the islands even depending on imported water. Mr. Churchill, in his speech in the House of Commons, mentioned this new base, and added, "We have begun the bombing attack upon military objectives in the Italian cities and bases in the South of Italy. That will continue on an ever-growing scale." The Southern Italians must be delighted at that prospect, and it will surely do a lot to increase the popularity of Signor Mussolini and the Fascist régime.

Later reports from Athens declare that British fighters have been in action over the mainland of Greece and have shot down at least one Italian machine there.

It was only to be expected that the Italian bombers would begin the slaughter of Greek civilians which is part of the Dictators' regular way of conducting war. The Piræus, the port of Athens, may perhaps be reckoned a legitimate military objective, though peaceful merchantmen in harbour are certainly not so. The Piræus was promptly raided, and British armed merchantmen lying there took part in the anti-aircraft fire, while two Greek fighters went up and engaged the five Italian bombers. Two of the enemy were shot down, and all the bombs fell into the water. Salonika was also raided, and there the civilian casualties were somewhat heavy. The island of Corfu was yet another objective, and the Italian bombers took particular aim at the British Consulate, but did not hit it. Yet another town to be raided was Larissa, an important centre of communications. It has been stated that Count Ciano and young Bruno and Vittorio Mussolini took part in the raid on Salonika, but it is hard to believe that a Foreign Minister should thus indulge his blood-lust.

FOR NAVAL OCCASIONS

Some news of the Fleet Air Arm's new two-seater fighter, the Fairey Fulmar, has been released. The main armament is eight Brownings mounted in groups of four in each wing, which gives it equal offensive powers with the Hurricane and Spitfire. In this *Flight* copyright drawing by "J. P.," of a hypothetical attack on some Savoias, the beautifully clean layout of the Fulmar is emphasised. The Navy is to be congratulated on acquiring such a hard-hitting, elegant weapon.

WAR IN THE AIR (CONTINUED)

The Italians tried to avenge the first R.A.F. raid on Naples by making an attack with 100 machines on Malta on Saturday, November 2. The raiders were met by intense A.A. fire, and British fighters went up and engaged them. The air combat lasted over an hour, and two Italian machines were brought down, while a third was badly damaged and unlikely to reach its base. Bombs were dropped, and some damage was done to Government property, but there were no casualties.

Meanwhile Marshal Graziani continues to prepare for his great invasion of Egypt. Light British forces persist in harrying his men both on the ground and in the air. A considerable air battle was fought over Mersa Matruh on October 31, of which details have now reached this country. The Italians in their official communiqué claimed that they lost only three aircraft and that we lost seven bombers and ten fighters. They also stated that although they were busy elsewhere, they still had time to thrash the British and chase them out of the skies. Their fantastic claim was answered in official R.A.F. quarters by the simple reply that there were no R.A.F. bombers in the battle at all. Our losses were one fighter shot down, two which collided in mid-air (both the pilots were saved by parachute) and one fighter missing.

There were many witnesses to this air battle, and one army officer stationed in a lonely camp far out in the desert declared: "If the stage had been specially arranged for us to see the R.A.F. in action, it could not have been better. I saw two Italian bombers burning in the air. One came right over our camp and we all thought it was going to fall on us, It just got over the hill before it crashed." One pilot who had a long chase after an Italian fighter said: "As I came back I saw three Italian machines burning furiously. I went over to get a better view and saw that our troops were on the scene. They gave me a cheer, which I acknowledged by flying round again, coming down low, and waving to them."

Unquestionably this fight was a great tonic to the British troops, as thousands of them saw the Italian machines either falling in flames or plunging into the Mediterranean. They saw the enemy bombers turn tail and make off, hotly pursued by the faster Hurricanes. They saw the enemy fighters once again inferior to the brilliant manœuvring of the Gladiators.

The Italian losses in aircraft were at least twice those of the R.A.F. and in personnel our losses were one pilot killed and one missing, while the enemy must have lost anything up to thirty. From the four Savoias and the four C.R. 42's brought down, only one Italian escaped. He was the second pilot of an S.79 which had a crew of five. He baled out, according to his own story, on orders from his first pilot. Another member of the same crew also baled out, but his parachute failed to open. The Savoia came down in a sheet of flames with no possible chance of any of the crew surviving. The remainder of the crew were buried by British soldiers close to the debris of their machines, which crashed into the rocky side of the Wadi. One of the S.79's had a crew of six. The pilot of one of the C.R.42's also had his last resting place out in the desert, a few yards from the remains of his burnt-out machine. In each case, British troops raised a pile of stones in which they put a cross made from the wreckage of the aircraft. In a bottle on the stones marking the grave of the fighter pilot, there are written these words: "Here lie the remains of one Italian airman, shot down in air battle on October 31st."

In addition to the eight Italian machines shot down, four more were seriously damaged.

The Raiding of Britain

THE intensity of the raiding by night on London and other British cities has varied of late considerably, probably on account of the weather. It was significant that on the night of Friday, November 1, five of the raiders were destroyed. It is confidently hoped that the number of victims will increase progressively. During that day the Navy shot down two bombers which attempted a dive-bombing attack on shipping in the Thames Estuary. One fell to the guns of H.M. Anti-Aircraft Vessel *Royal Eagle*, and the other to those of a motor launch. The first victim exploded on striking the water and there were no survivors. One man was picked up from the second, a Ju.87 dive-bomber.

Sunday, November 3, was remarkable because there was no night raiding at all over London, obviously because there was extremely bad weather in France and gales over the English Channel. Last winter, the R.A.F. in France found that the aerodromes which they had to use there were very apt to become water-logged in wet weather. They cursed them then, but now the soggy condition of those aerodromes is a blessing to Britain.

The Fighter-Bombers

THE raiding has again been mostly carried out by fighter-bombers, with the result that, while the losses of aircraft on both sides have been low, the amount of damage done by the bombs has also diminished. As the Prime Minister pointed out, in September the weekly average of killed and severely wounded was 4,500; in October it shrank to 3,500. Occasional clear nights bring more raiders across, but the really bad slaughter periods which London endured at the beginning of September have not been reproduced of late.

Capt. Harold Balfour, Under-Secretary for Air, gave an Empire broadcast on November 4, in which he referred to the recent relief from mass raids by daylight, and then continued: "If they try to resume those raids let me assure you that, with the same skill and courage, still greater forces of fighters await them. Now the German High Command has turned its attention to the indiscriminate bombing of our cities by night, carried out with a wantonness and disregard of the civilian population which has only had the effect of rousing the spirit of our people still further in their determination to beat the German menace at any, and all, cost. Offence is not the prerogative of the Germans, for the war cannot be won by defence alone. Our bomber striking force nightly blasts its powerful mark on to German factory, mine, railway and aerodrome. I know I echo the wish of every one of you who listen when I say, as to the fighters so to the bombers: 'Good luck, and good hunting.'"

The Queen and the W.A.A.F.

THE King and Queen are indefatigable in visiting and cheering all classes of their subjects, one day going among those who have suffered from the bombing and the next day inspecting some branch of the Forces. Among the latter it is gratifying to learn that the Women's Auxiliary Air Force has not been forgotten. Not long ago the Queen was at a station of the R.A.F. Fighter Command. Attached to this Command are some 2,000 W.A.A.F., and during the attempt of the *Luftwaffe* to break the power of that Command the women had to endure the bombing of its stations just as the men had to do. The Queen said to the senior W.A.A.F. officer of the Command "I hear that your women are magnificent." "Thank you, Your Majesty," said the W.A.A.F. Squadron Officer. "Magnificent is the best word for them."

That Squadron Officer has a file which tells of heroism displayed by the W.A.A.F. at different fighter stations. It is an amazing record of courage and fortitude during bombing attacks. When, the morning after a bitter attack on one aerodrome, the Squadron Officer saw the Commanding Officer of the station, he said: "Madam, your women are wonderful. I would not mind if my whole station were completely manned by them."

A Squadron Leader in charge of the administration side of one fighter station owes his legs—and probably his life—to one W.A.A.F. He was wounded by a bomb which fell near the entrance of a shelter he was about to enter, and his legs were badly injured. A girl, who was

ACHTUNG: Field-Marshal Göring addresses a staffel of the Luftwaffe.

WAR IN THE AIR (CONTINUED)

a nurse before the war, ran to him as he lay. He was losing blood very fast, but she immediately improvised a tourniquet and stopped the flow. Meanwhile, bombs were still falling near, but she helped a station medical officer to take the injured officer to sick quarters. When the raid was over the Squadron Leader was taken to hospital, where the doctors declared the girl's prompt action had saved his legs from the necessity of amputation.

At another station one girl was near the entrance of a shelter when a bomb exploded, and several were injured, including herself. Casualties were brought in from outside, and the medical staff were immediately at work. Always this girl kept saying to them, "Look after the others, don't worry about me. I am all right." But after about half an hour when one of the doctors looked at her he saw that she was desperately ill. He examined her and found that she had a broken back. She protested that she was "quite all right." She was taken to hospital and for weeks was lying with her back in plaster. When, although the plaster was still in place, she was able to walk, one of the first things she did then was to write to her C.O. and say: "Please may I come back to work?"

A Yorkshire Squadron

THOUGH we all talk about the easing off of the German air attack, the Fighter Command has still to maintain its ceaseless vigilance by day or else London and other cities would continue to suffer severely. Squadrons are winning reputations in the Service, and after the war is over the public will learn their names and numbers. Occasionally the veil is lifted a little—in fact of late the official communiqués have mentioned the numbers of certain squadrons whose members have distinguished themselves. On the whole, the squadrons of the Auxiliary Air Force keep their identity more continuously than those of the regular R.A.F., though in wartime casualties and the need of giving pilots a rest from continual fighting must cause changes in the personnel of any squadron. One A.A.F. squadron from Yorkshire has recently completed its century of German machines shot down. The hundredth victim was a Ju 88 shot down off the South Coast by two Spitfires of the squadron. This squadron has fought with distinction in all the important phases of the air war—at Dunkerque, in the Channel battles, and in the defence of London and the cities of the South and West. Over the beaches of Dunkerque nine of the squadron's Spitfires shot down in one day four German bombers and two Messerschmitt 109 fighters. This was the squadron's first real baptism of fire, and since then they have been kept very busy. They helped to foil the German attempt to gain control of the Channel—flying protective patrols over convoys and helping to fling back Göring's mass attacks, which were to have been the prelude to invasion. One of their most successful days was in August when, within the space of a few minutes near Portland, they shot down nine Junkers 87 dive bombers and four Messerschmitt 109s as well as damaging another seven of the enemy. This big victory was achieved without loss to themselves. In the following two days they added eight more to their bag. During the first big raid on London the squadron was in the thick of the dog-fighting. The pilots shot down two Messerschmitt 110s, a Dornier 17, and a Messerschmitt 109—again without loss to themselves. One of their pilots did a particularly good job over Southampton. By dodging escorting Messerschmitt fighters, he was the first to get in an attack on a formation of 70 bombers. He started the break-up of the formation before other British fighters swept into the battle. At the end of this engagement, which lasted half an hour, the raiders had all been driven off with the loss of fifteen bombers and sixteen fighters.

The British Offensive

OBVIOUSLY the R.A.F. could do with more bomber aircraft than it has got. In recent weeks there have been many raids on Kiel and other German naval bases and dockyards, but none the less a commerce raider is said to have got loose in the Atlantic, and rumours suggest that it may be either the *Deutschland* or the *Admiral Scheer*. It has been impossible for the Bomber Command to watch and bomb everything.

Nevertheless that Command keeps on plugging away, and on *Tuesday, November 5*, special attention was paid to German ship-building yards. Explosions of such violence that they could be heard above the roar of the engines by a bomber crew several thousand feet up, marked a heavy attack on ship-building yards at Bremerhaven. The raid began shortly after 7.15 p.m., and for over an hour the Sebach ship-yards were bombed from a cloudless sky by relays of aircraft. Sticks of heavy-calibre bombs repeatedly straddled the yards, and others were seen to strike the quayside and explode near dock buildings in the Columbus Bauhafen. More than thirty separate fires, some of which were described by a pilot as "diamond-shaped areas of flame," were started in the shipyards and, for some time after the attacks had ceased, their red glow could be seen through the curtain of haze and smoke which lay over the dock.

Petrol storage sheds in the naval dockyards at Emden were simultaneously attacked by a second raiding force, and many large fires were started in the course of fifty minutes of almost incessant aerial bombardment. Tons of heavy explosive bombs and nearly a thousand incendiary bombs were dropped on the target in a series of high-level attacks and in shallow dives which, at times, brought the raiding aircraft down to less than one thousand feet.

The naval dockyards at Bremen and Vegesack were also attacked by smaller forces. Three large red fires were started near a ship-building yard at Bremen, and at Vegesack heavy-calibre bombs were seen to burst on and around the Vulcan ship-yards.

AIR LOSSES DURING WEEK ENDING NOVEMBER 9

	GERMAN Aircraft	BRITISH Fighter Aircraft	BRITISH Pilots
Nov. 3	1	1	1
" 4	—	—	—
" 5	8	5	2
" 6	6	4	3
" 7	7 + 1 by R.N.	5	—
" 8	20 + 2 by R.N.	6	3
" 9	7	—	—
	49 + 3 = 52	21	9

British Bomber losses over enemy territory:—Nov. 3, 2; Nov. 5, 2; Nov. 6, 2; Total 6.

Hamburg had one of its earliest raids recently when a heavy attack was opened on one of the city's principal electrical power stations situated in the Neuhof. The explosions of heavy-calibre bombs started many fires in the vicinity of the power station which were soon blazing fiercely. Later in the attacks, which continued for nearly an hour, a whole street was lit up by the flash of a bomb of the heaviest calibre, the dull red glow of its explosion lasting for fully three minutes.

November 8 was the anniversary of the first attempt of the Nazi party to seize power by force in the abortive *putsch* of 1923. The headquarters of the conspiracy was the famous beer cellar at Munich, and there on each anniversary Herr Hitler goes to celebrate and to broadcast. This year, however, it appears that the ceremony was held in another building. The R.A.F. visited Munich that night and bombed it heavily. Some reports say that the beer cellar was hit, but this does not seem certain. Hitler spoke for over an hour. The R.A.F. arrived soon after.

The R.A.F. Middle East Command, now with a useful base in Crete, has begun to strike seriously at the Italian bases. The port of Valona in Albania has been bombed, and there has been more than one raid on Brindisi. Such blows, if persistently repeated, as no doubt they will be, must have a serious effect in interfering with the shipping of supplies from Italy to Albania. The Bomber Command has also directed more raids against Turin and Milan.

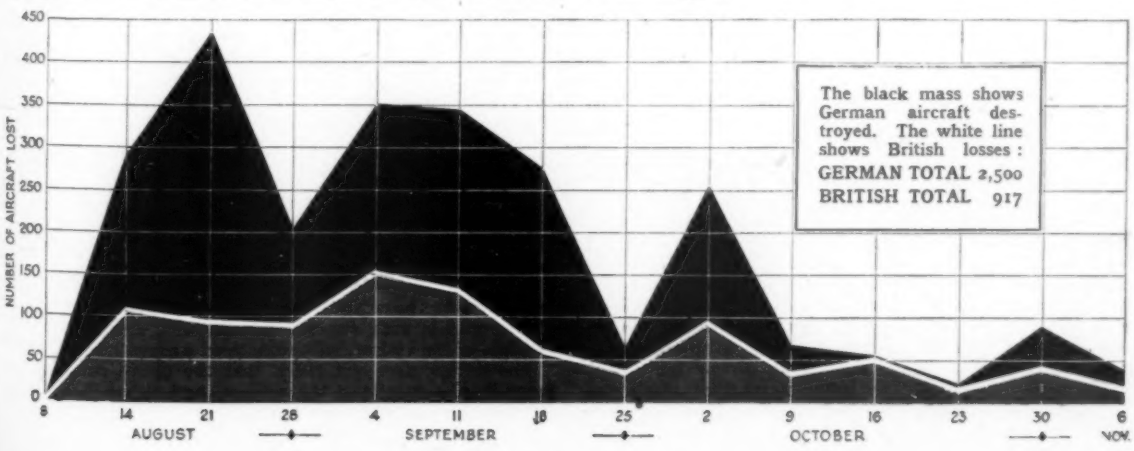
THREE MONTHS' AIRCRAFT LOSSES

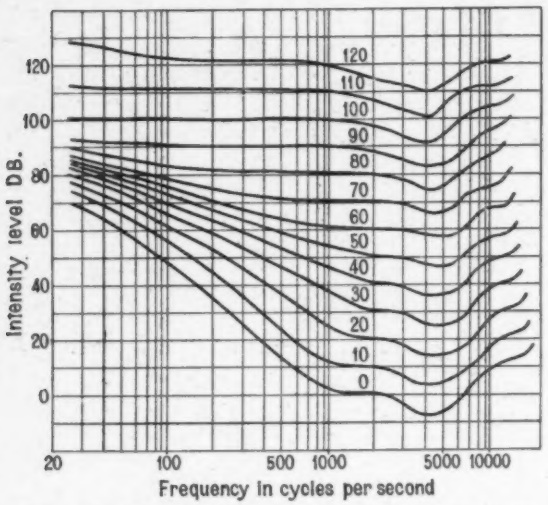
IN the chart below the course of the German attempt to overwhelm the R.A.F. Fighter Command is clearly shown. The black mass represents the losses of the Germans, week by week, while the white line shows the losses of British machines, both fighters and bombers. The white line takes no account of British pilots killed or saved, a fact which must vary according to whether men are fighting over their own country or over foreign territory. What the white line shows is the effect of the fire from the German machines and *Flak*. The losses of British bombers have not been heavy enough to have much effect on the course of the white line.

It would have been instructive if it had been possible to show on the chart the comparative numbers of German fighters and bombers shot down, but that was impossible because of the great number which were shot down into the sea and were never certainly identified. For instance, on one great day, August 15, 37 German bombers were brought down on British soil and 57 fighters, but 87 others were destroyed which were never identified. Again, on August 18 our fighters shot down 63 bombers and 60 fighters, but 30 more were never identified. One cannot therefore conclude with certainty that during that month the British defence was shooting down a greater number of fighters than of bombers, though on days of less activity there seems to have been a tendency in that direction Perhaps when meeting the first German mass attacks the British fighters indulged the natural instinct of fighters, namely, that the escort must be destroyed before the convoy is tackled. The escorts in August were not on an abnormally large scale. Gradually, however, the defenders learnt the tactics which permitted them to increase the proportion of bombers which they shot down, while at the same time protecting themselves from undue losses at the hands of the escorts. The white line remains pretty steady through the latter half of August.

A new German effort can be seen starting in the first week of September, and the R.A.F. losses rise slightly in consequence, but by no means in proportion. The Germans at that time were increasing the numbers they sent as escorts, but during the period the British fighters were gradually defeating those tactics. On the record day of September 15, the German total losses were 185 machines, of which 110 were certainly bombers and 27 were not identified, while only 48 were certainly Messerschmitts or other fighters. After that heavy blow the lines show a distinct period of easing off on the part of the Germans. There was a momentary recrudescence on September 27, when the total enemy losses amounted to 133 (over 90 of them fighters!) and then the lines drop down and remain fairly low and level. The great air invasion attempt was over; the R.A.F. had won its historic victory, and the Germans withdrew most of their heavy bombers from the conflict.

The proximity of the two lines in October marks the use for the most part of fighter-bombers. Naturally they had a better chance of avoiding destruction, and of occasionally shooting down defenders. Once or twice the white line of R.A.F. losses coincides with the black line of German disasters. This may be partly accounted for by the growth in the intensity of British raiding on hostile territory, which inevitably produces the loss of some British bombers, although the proportion is extremely low. As the centre of interest has now shifted from Great Britain to the Mediterranean, there seems little chance of future months showing a new large-scale air attack on the centre of the Empire.





Curves showing intensity levels for various reftone levels obtained in free-air listening conditions.

RUMM-RUMM BIRD

A Survey of the Identification of Aircraft by Sound

By C. CAMPBELL, M.Sc.

Member of the Technical Staff of the Engine Department of the Royal Aircraft Establishment, Farnborough.

THE problem of the "Rumm-rumm Bird" has involved much thought in recent months and produced several hastily formed opinions, which have developed of late into a veritable scrum. Some of *Flight's* readers have drawn red herrings across the path of true research by confusing the characteristic sounds of various types of aircraft when flying at low altitudes with the real problem of high-flying sound detection.

Mr. G. A. L. Lis (p. 330, October 17 issue) seems to be working along the right lines when he suggests that "a Blenheim or a Hampden will also give a 'Rumm-Rumm' at anything over 15,000ft." His conclusion that "a Short Sunderland (Pegasus) can never be said to have the same sound as two Wellingtons" is based on experience at low altitudes, where the characteristic noises of airscrews, the "mangle-like" noises of certain types of reduction gear, and the effect of the slip-stream on the wing and fuselage surfaces can assist in giving every type of aircraft a distinctive signature tune.

There seems to be little doubt amongst those who have had the opportunity of listening to different types of aircraft at high altitudes that most twin-engined aircraft produce a beat. In the case of German aircraft it appears to be a regular beat, while British aircraft produce an irregular beat We are presented, therefore, with two separate problems. Why do we hear a beat at high altitudes when a more continuous sound is made at low altitudes? Secondly, why the difference in beat regularity between British and German aeroplanes?

To answer the first question, the noises produced by an aeroplane in flight must be classified and analysed. They can be divided into at least five separate sources:—

1. Exhaust noise. 2. Airscrew noise. 3. Engine mechanical noises. 4. Natural and forced vibrations in the aircraft structure. 5. Slip-stream and eddy noises.

The beats that can emanate from such complex sources defy analysis. Some of the more apparent are:—

1. Beats between the engines of the same plane. 2. Beats between the engines of different planes. 3. Beats between dissimilar engine noise, i.e., air-screw and exhaust. 4. Beats between two or more air-screws. 5. Beats between two or more exhausts. 6. Beats between the air-screws and the fuselage of the leading edge, etc.

At speeds higher than tick-over, by far the loudest beats are produced by the air-screws and the exhausts. The fundamentals and harmonics of these wave-forms produce a wide gamut of beats of many frequencies. It is well known that noises of high frequency are absorbed by the atmosphere to a greater extent than those of low frequency, consequently it is only the latter beats that reach the human ear from a high-flying aircraft. Naturally the wave-forms, from which the out-of-phase and in-phase effects produce the audible beat, are quite inaudible when the aircraft are at altitudes of 20,000ft. or more.

The beating effect is greatly accentuated by the relationship between the decibel or "sound power" scale and the reftone value or "loudness level" scale. This relationship is shown in the curves of constant reftone value or constant loudness level plotted against the two variables, intensity level and frequency. It is seen that, for low-frequency sound waves, a small change in the power (decibels) produces a large change in the reftone value, i.e., the apparent loudness as recorded by the ear. This means that a small rise and fall in the sound energy of the aeroplane's beat will produce a large variation in observed loudness level.

This accentuation of low-frequency beats and the attenuation of all high-frequency sounds by the atmosphere are the joint causes of the familiar "rumm-rumm." It must be understood, of course, that it makes no difference how many aeroplanes are present, provided they are flying high enough to eliminate the higher frequencies. It would be interesting to know for certain whether two or more high-flying single-engined aeroplanes give an audible beat. The author has observed a faint irregular beat from a large number of our fighters flying at 15,000ft. Why this is not more pronounced in single-engined aircraft is not quite clear at the moment. One explanation would lie in the position of the engines relative to the wings. If the audible beat is caused by the interaction of airscrew or exhaust noises on the wing surfaces, or on the leading edge, it is obvious why groups of single-engined aircraft are incapable of making a pronounced beat.

A *Fundamental Difference*

When approaching the question of the differences in beat regularity the writer looked for a fundamental difference between British and German aircraft. The airscrews, exhaust systems and fuselage shapes of the various types used by both countries suggested no line of demarcation, but when attention was directed to the engines one common feature of German types, which is unknown in British military aircraft, was brought to light. German military engines, with the exception of a few obsolescent float-plane and converted commercial plane engines, are fitted with fuel injection equipment. All British engines have carburettors.

As a direct consequence of this a German engine, when adjusted to a cruising mixture strength, will run at a constant speed without the slightest deviation from this speed, provided all other variables are kept constant. A British engine, however, suffers slight variations in the fuel metering, which are reflected in the engine speed. Since the engines of a multi-engined aircraft do not experience fluctuations in metering at the same instant they do not "hunt" in phase. Consequently any beat due to a slight difference between the mean engine speeds or due to superposition of dissimilar sources, i.e., the engines and the airscrews, is irregular in character, varies in amplitude, and is not so pronounced as with the constant-speed German engines.

It is to be expected that "bumpy" flying weather will interfere with the engine speeds of both German and British planes, and in such weather the continual changes in the attitude of the aircraft will produce an uneven beat.

The author does not claim that the above constitutes more than a survey of the subject, and although he has attempted to present a working hypothesis he anticipates gradual changes in the light of future experience.

GUNS PER BOMB

Armour Plate of No Avail Against Head-on Attack

THAT every German is born a potential General and sees everything in the light of its possible military uses is common knowledge. An outstanding example of this was the adoption of the Eschner parachute for parachute troops. It was demonstrated in this country —by a German, incidentally—to show how drops could be made from a height as low as 300ft. Our interests lay in its possible use in case of trouble at low height. The German military mind, on the other hand, saw instantly that this solved all the major problems of dropping parachute troops. The vulnerable period during the descent was cut almost to nothing, and the groups of men alighted close to one another instead of being spread over half a county.

It is also axiomatic that an offensive military vehicle, whether it be ship, tank or aeroplane, must possess such offensive and defensive powers as will enable it, by taking reasonable chances, to reach its target, do its work and return to its base. It is thus almost unbelievable that the Germans should have failed to provide most of their aircraft with a sufficiency of either of these powers.

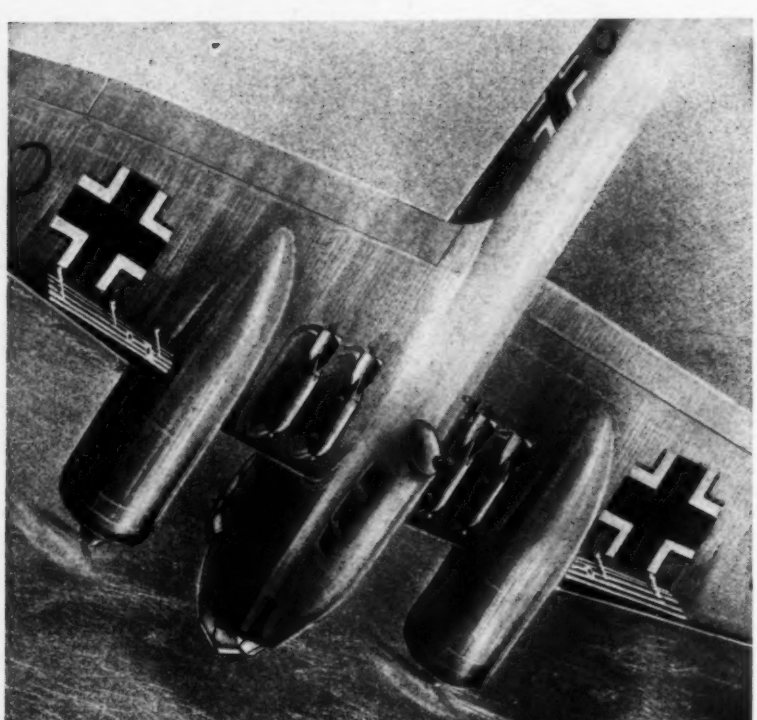
TWO NAZI NOSES : Above is the beetle's eye nose of the Dornier Do 215 showing the excellent view enjoyed by the pilot and bomb-aimer of our eight-gun fighters in a head-on attack. On the left is the "toothache" face of the Heinkel He 111. The forward gun position is in the articulated blister, and the inadequate egg-shaped panel for the bomb-aimer is seen underneath.

In the early phases of the war, when for months none but lone raiders or small formations of bombers raided our naval bases and coastal shipping, the difference was most marked. The Heinkel He 111s and Dornier Do 17s and 215s were easy meat if an interception was made by our eight-gun fighters, and the theory of the elusive bomber, lightly armed but of high speed, was proved utterly false. On the other hand, the British Wellingtons, Whitleys, Hudsons, Lerwicks and Sunderlands each had power-operated multiple-gun turrets which, in most cases, gave them almost equal armament with any Messerschmitt Me 109 that tried conclusions with them. Even the Blenheim, which had at that time only a single Vickers K gun for rear protection, was better off than its German counterparts by virtue of the fact that the single gun was in a power-operated mounting.

Bombers Heavily Armoured

To increase the armament of an aircraft is a major modification, even in the most favourable circumstances; to design and fit power-driven turrets to existing designs is almost an impossibility. So it was found that although the Heinkels and Dorniers became more and more difficult to shoot down, this was not due to more powerful offensive weapons being fitted, but to slabs of armour plate covering vital areas. Alongside, as further passive resistance, so to speak, leak-proof fuel tanks increased the amount of "lead" necessary for a kill.

Then came the invasion of the Low Countries and the battle of France, in which Junkers Ju 87 dive-bombers were used—and shot down by Hurricanes—in their hundreds; but they did their job. The co-ordination of air and ground



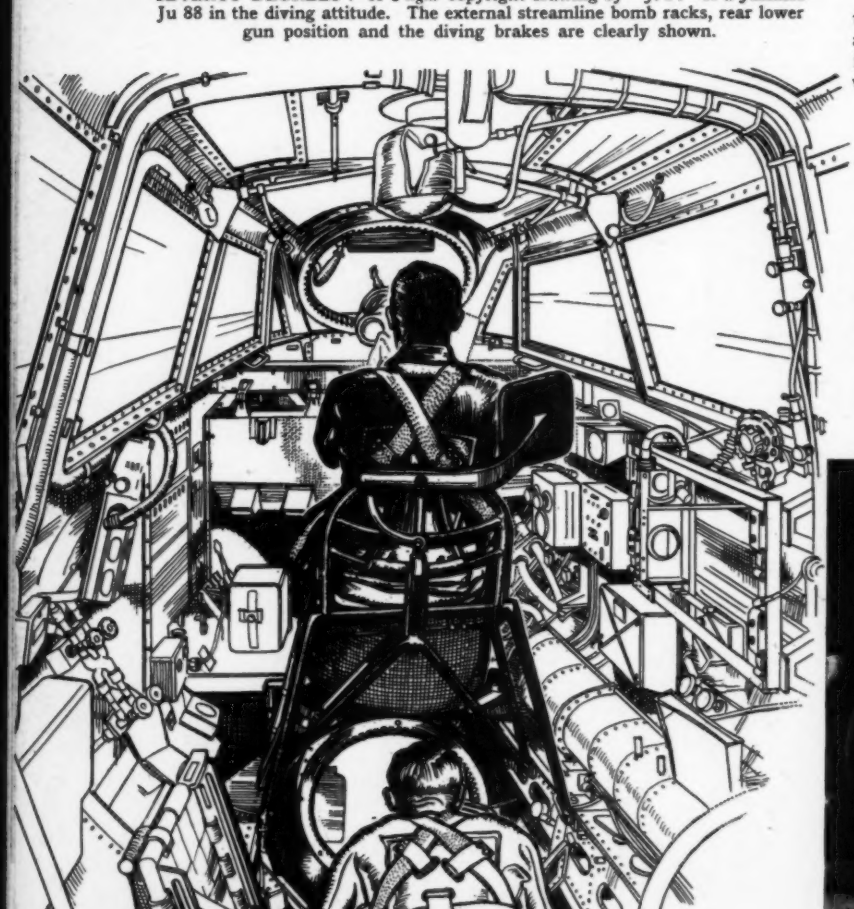
SEVENTY DEGREES : A *Flight* copyright drawing by "J. P." of a Junkers Ju 88 in the diving attitude. The external streamline bomb racks, rear lower gun position and the diving brakes are clearly shown.

GUNS PER BOMB (CONTINUED)

forces in the German offensive showed a military imagination which made the rest of the combatants look like amateurs. The Allied High Commands, particularly the French, must have been utterly incompetent for, with the exception of the employment of parachute troops, the whole system of air-cum-tank attack had been revealed in the Polish campaign nine months earlier. At the same time as the military operations were going on in Holland and Belgium there was the separate war carried on against civil populations, and it is here the *Luftwaffe* was seen at its best. By the employment of huge formations of bombers, encountering little or no resistance from the ground or the air, they killed 30,000 people in Rotterdam in under twenty minutes. Eighteen minutes is the boasted figure.

Thus the stage was set for the battle of Britain. Since the employment of large formations of bombers had proved so successful, it is not surprising that this was tried out with all the persistent reckless disregard for loss of both material and life which only the German military machine can contemplate.

Here is a different story to tell. For the first time the Germans were up against a well-trained and well-equipped, if numerically inferior, metropolitan defence force which was spoiling for a scrap. The



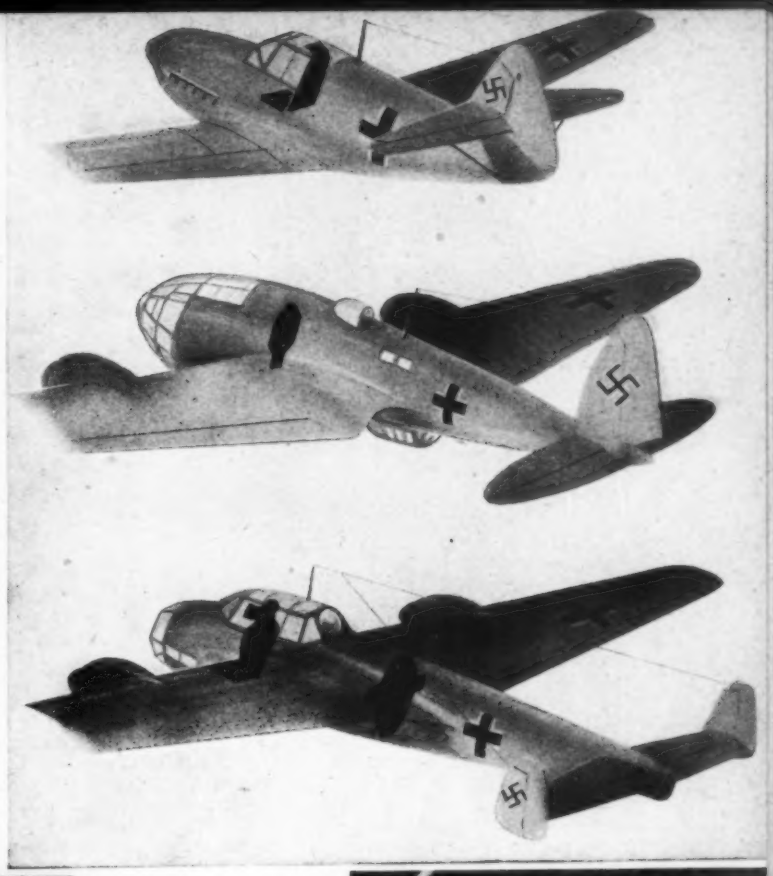
NASAL NASTINESS : (Below) The fixed armament of the Me 110 consists of four 7.9 mm. machine guns in the upper nose and two 20 mm. Oerlikon shell guns in the lower cowling.

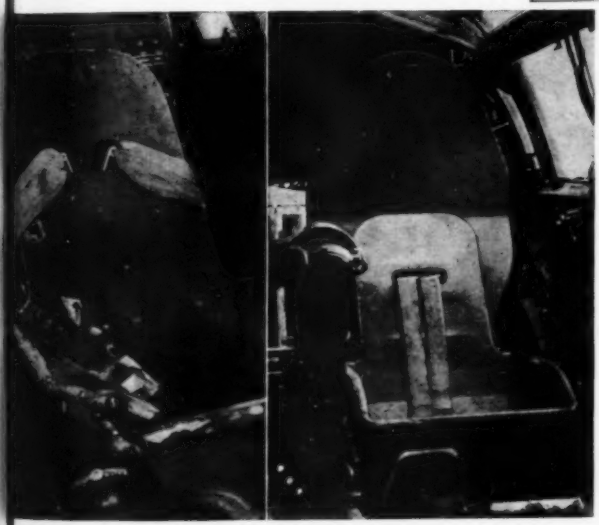
BACKFIRING : (Left) The cockpit and rear gunners of a Do 215. Each gunner has a single 7.9 mm. machine gun universally mounted in a circular rotating gun ring. Above the top gunner is seen the radio loop control and, on his right, the receiver and transmitter. The net beneath his seat prevents cartridge cases from falling on the lower gunner. On the port side are the controls and pipes for the oxygen supply. Spare ammunition is kept in the container under the top gun.—*Flight* copyright sketch by R.E.P.

GUNS PER BOMB (CONTINUED)

outstanding feature of the air fight was the disintegration of these bomber formations by the head-on attacks of our Hurricanes and Spitfires. Our machines came in off a deep echelon, almost line astern, in an unbroken stream. The *Luftwaffe* was trounced in no uncertain manner, and, leaving the matter of spirit, dash and bravery on one side for the moment, the material advantage of the eight-gun fighters plus their bullet-proof windscreens meant that the German formations had to fly into an almost continuous rain of bullets fired at the rate of 10,000 per minute. Their armour plate was of no avail against this, and time after time these huge formations were broken up and utterly routed.

To watch one of these formations broken up by the Fighter Command pilots was a sight of rare beauty. The writer watched one such formation which approached London, split in two and turned back while the German protecting fighters, which were so numerous as to appear as a swarm, sailed serenely on, giving their charges no support whatsoever. Another mass attack which developed in the Croydon area in the morning of the Sunday during which the R.A.F. made their record score was smashed into its separate machines, and, seen from the ground, became a whirling tangle of aircraft against a background

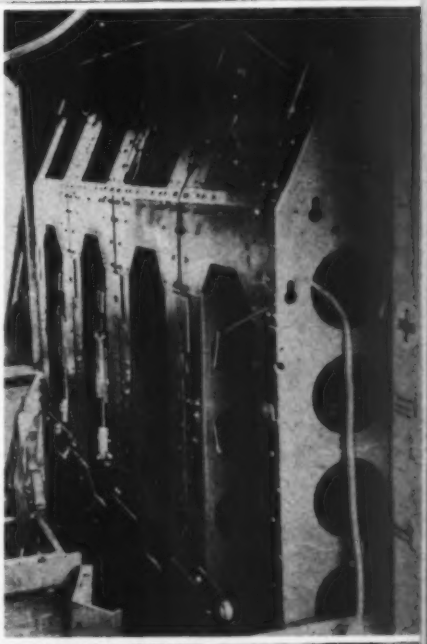




CREW COMFORTS : (Above) An indication of some of the armour protection found in various German aircraft. Reading from the top downwards the machines are Me 109, He 111 and Do 215.

CAUSE AND EFFECT : (Left) The unprotected pilot's seat found in a Heinkel He 111 brought down in the early days of the war compared with the modern armoured type.

INS AND OUTS : (Right and below). The vertical bomb stowage on the He 111 showing the separate compartments and segmented bomb doors. Provision is made for eight 250-kg. bombs or their equivalent.



of blue framed by great white cumulus clouds. Occasionally a machine could be seen leaving the flight vertically, with an evil trail stretching out behind, and here and there the white canopy of an open parachute.

Eventually even the Germans had to realise that the mighty creation of Goering had more than met its match. From then onwards we see an ever-increasing proportion of fighters to bombers and the realisation by the enemy that guns per bomb are a very definite factor. This change of tactics was such that, during the daylight raids on this country, the proportion became something in the nature of 40 fighters to nine bombers; and eventually the fighters themselves were turned into improvised bombers. The Messerschmitt Me 109 had racks fitted to take one 250-kg. bomb or four 50-kg. bombs, and its compatriot, the twin-engined Me 110, has been adapted, as in the Jaguar model, to take two 250-kg. bombs each.

Having reached this latest phase of the air

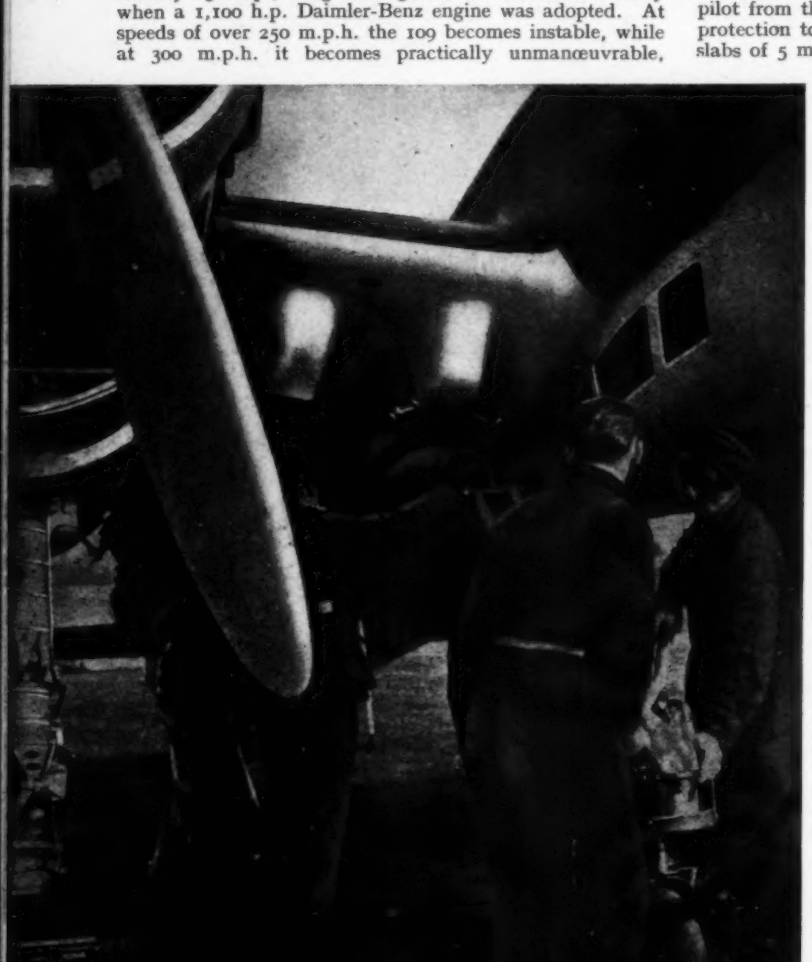
OUTCLASSED. Me 109 showing clearly the poor armament compared with our fighters. Gun troughs in the top cowling carry the synchronised guns, and the muzzles of the wing guns are slightly inboard of the automatic slots. An engine-mounted 20 mm. shell gun is indicated by the hollow hub of the airscrew.

war, we can study individual enemy machines in the light of their offensive and defensive powers, both as fighters and as bombers, and perhaps draw some conclusion for probable future development. Digressing for a moment, it must not be forgotten that while the night bomber is, at the moment, comparatively immune from air attacks, this immunity, as has been hinted at in official circles, is due to be curtailed at an early date.

As a fighter the Me 109 makes the poorest showing of any of the enemy types. Originally designed for an engine of only 650 h.p., wing loading and control suffered badly when a 1,100 h.p. Daimler-Benz engine was adopted. At speeds of over 250 m.p.h. the 109 becomes instable, while at 300 m.p.h. it becomes practically unmanœuvrable, owing to the stiffness of the controls. This stiffness increases as the speed goes up, and at 400 m.p.h. the controls are to all intents and purposes solid. In a tight turn with plenty of *g* the automatic slots are prone to open in a high-speed stall, and aileron flutter develops.

The 109 has a variety of armament arrangements, but it always has two rifle-calibre machine guns lying on the top of the crankcase of the inverted engine, these being, of course, synchronised to fire through the airscrew disc. This limits the rate of fire very considerably. In each wing, outside the airscrew diameter, is provision for either another machine gun, which can make use of its full rate of fire, or for a 20 mm. shell-gun. Provision was originally made for a shell-gun firing through the airscrew hub, but machines fitted with these are rare. As "static defence" there is a sheet of 8 mm. armour plate which protects the pilot from the rear, curling over at the top to give added protection to the head. The parachute seat is lined with slabs of 5 mm. plate, but, since the pilot is virtually sitting on the petrol tank, this is not very comforting. An attempt has been made in some of the 109s to provide protection from the front by fitting windscreens of plate glass more than two inches thick and of doubtful bullet-proof efficacy, but the majority have only the standard thin laminated splinter-proof material.

Willy Messerschmitt's other fighter, the Me 110, is a good deal more ambitious in its offensive armament, having no fewer than four fixed machine guns in the top nose fairing, and two 20 mm. shell-guns in the lower nose fairing. Assuming two machine guns to equal one shell-gun, this brings its offensive powers up to that of one of our eight-gun fighters, but with the disadvantages of having a machine of three times the weight, carrying a crew of three, and with all the complications of the twin-engined arrangement. This comparison is not quite fair because the Me 110 is a long-range and escort fighter. It should, therefore, be compared with such machines as the Blenheim fighter; but this, in its turn, is not fair because the Blenheim fighter is a converted bomber. The Me 110 carries a crew of three, and for tail protection there is a swivel-mounted 7.9 mm. machine gun with very restricted angles of fire. There is no armour plate fitted, and our pilots do not consider it difficult to shoot down, although, in the hands of a resolute crew, it is a first-class fighting unit.



FOR DIVERS REASONS : German armourers fitting one of the four 250 kg. bombs to the streamline external racks of the Ju 88 dive bomber. The position of these racks, coupled with a diving attitude of 70 degrees, obviates the necessity of using ejector gear to clear the airscrews.

GUNS PER BOMB

GUNS PER BOMB (CONTINUED)

PREVENTS THAT SINKING FEELING! : Enemy bombers have an inflatable rubber dinghy for use in the German Ocean. Fighter crews just swim for it.

In emergency the whole of the transparent covering of the crew space can be jettisoned by one control to facilitate the escape of the crew by their parachutes. In the present phase of the air war this long-range fighter is being used as a bomber in small formations of six or so, each carrying two 250-kg. bombs on external racks. In this guise it represents the greatest crew-gun per bomb density of any type in use, and shows clearly the strain to which the *Luftwaffe* has been put in its endeavour to establish some sort of daylight air superiority over England. Moreover, it must be remembered that these converted fighter-bombers are also protected by considerable numbers of non-bomb-carrying fighters of the same breed.

The Heinkel He lll is a bomber pure and simple, and, in its original form without armour protection, was about the easiest target our fighters encountered. Even to-day the amount of protection varies a good deal, being limited, in most cases, to a large slab of 8 mm. plate behind the pilot's seat. Before the elusive bomber theory was proved wrong the He lll's armament consisted of three rifle-calibre machine guns on hand-operated swivelling mounts. One fired forward through the centre of the bomb-aimer's compartment in the nose, and the other two fired aft, one above the fuselage and one below. It was impossible to increase the nose armament without redesigning the nose panels, but twin guns are now sometimes found in the rear positions, and the most recent model has an extra machine gun on each side of the fuselage firing at right-angles to the line of flight. In an endeavour to preserve the streamlined shape of the Heinkel's nose the pilot's view straight ahead and slightly upward is spoiled by the bad angle of the windscreen. The refraction at these small angles must play all sorts of tricks with the vision. It may be that the head-on attacks had not been visualised at the time the He lll was produced. The bomb-aimer has plenty of visibility in front, but the egg-shaped panel through which he takes his actual sight is very inadequate compared with the large, optically flat panels provided in all of our types.

Bombs Stowed Vertically

Peculiar to this machine is the vertical stowage of the bombs. Provision is made for eight 250-kg. bombs or their equivalent, each in its own compartment and, contrary to expectations, they are stowed fins downwards, each bomb having to execute a complete somersault after being released. Special containers to hold numbers of incendiary bombs or other forms of air hate can be fitted. The Heinkel He lll all-up weight with normal load is 24,200 lb., and its maximum speed 274 m.p.h.

The Junkers concern at Dessau has specialised in the production of dive-bombing aircraft, and although the Ju 87 was used extensively in Poland and France, it is now considered more or less obsolescent and the Ju 88 has taken its place. Whereas the 87's main weapon of offence was one 500-kg. bomb, carried in a discharging cradle under the fuselage, the Ju 88 has provision for four 250-kg. bombs on external carriers, and internal racks are fitted to take sixteen more bombs of 50 kg. each. These latter are carried immediately aft of the crew space in the fuselage and can, if required, be replaced by a long-range fuel tank. The internal bombs can, of course, only be used for level or shallow-dive bombing. When the machine is used as a dive-bomber, hydraulically-operated air brakes come into play to limit the diving speed, and an automatic pull-out mechanism—interconnected with the pilot's bomb release—relieves the pilot of responsibility in this direction. Defensive armament follows the standard German pattern of employing one 7.9 mm. machine gun firing forward from a hand-operated mounting in the pilot's windscreen, another of the same type firing aft from below the fuselage, and the third pointing aft above the fuselage. All three of these have rather restricted movements. As in the case of the He lll, it has been found necessary in later models to double the top rear armament and to ward off beam attacks by fitting machine guns firing at right-angles on each side.

The modern form of the Dornier Do 17, that is to say, the Do 215, has been met with in greater numbers than any other bomber of the *Luftwaffe*. It has either water-cooled Daimler-Benz engines of 1,100 h.p. each, or B.M.W. 132 air-cooled radials. Credited with a speed of 310 m.p.h. it was, at the time of its inception, considered to be the elusive bomber *par excellence*. This would have held good but for the rate of climb and the 370 m.p.h. or so of the

CHAMBERLAIN CALLING : A battery-operated emergency wireless set with its umbrella and kite aerials. S.O.S. is radiated automatically.

GUNS PER BOMB (CONTINUED)

home-defence Spitfires. In their early raids on trawlers, lightships and coastal shipping, a very high percentage were shot down, and for many months the Fighter Command were able to claim that no fighter had been lost in or around Great Britain.

As time went on, however, it was noticed that more and more "lead" was needed to bring the Dorniers down. This was not surprising when it was found that the pilot had armour plate covering his back and head, as well as 5 mm. protection on the sides and bottom of his parachute seat. In addition ear pieces were fitted to guard his head against beam attacks. The crew generally are protected by a complete bulkhead of 8 mm. plate, fitted across the fuselage approximately at the position of the trailing edge, and by a diamond-shaped panel which is situated in the roof of the cabin, aft of the top rear gun position. The "beetle's eye" nose of flat safety glass facets gives excellent visibility to the pilot and bomb-aimer, but it is doubtful whether the latter is as well off in this respect as is the prone bomber in a long-nosed Blenheim, which is the nearest equivalent in the R.A.F.

The defensive machine guns, of which there are three, are mounted in universal ball fittings. Two fire aft, above and below the fuselage. The third fires forward, through the starboard windscreen. This gun can be used either as a free gun or locked rigid and aimed by the pilot through fixed sights. The bombs, of which 2,000 lb. can be carried, lie in the usual horizontal racks fitted internally to the rear of the lower aft gun position.

Although the German military mind is quite prepared to throw lives away by the thousand to obtain an objective considered worth while, every possible provision has been made to preserve the lives of air crews should they be brought down either by the R.A.F. or other, for them, fortuitous circumstances. Each member of the crew has an Irvin-type parachute, but the harness appears old-fashioned by comparison with ours; where stretches of water have to be covered an inflatable rubber dinghy is provided. For inflation, a clumsy pair of bellows, reminiscent of ye olde fireplace, are provided.

The Heinkel He lll has a very comprehensive battery-operated emergency wireless outfit, complete with a collapsible umbrella aerial and a kite aerial. Messages can be sent out manually in the morse code or, by the operation of a single switch, the set can be made to broadcast S.O.S. automatically and continuously.

Having learned their lesson it is now to be expected that German designers will go to the other extreme and tend to over-gun their aircraft, especially since big supplies of petrol do not now have to be carried. This, in its turn, will probably mean an inability to carry sufficient ammunition for long engagements, for in this air war business one cannot cheat, and every pound of weight or cubic inch of bulk must be paid for.

GUNS AND NO BOMBS: Good as our eight-gun fighters are—and even to-day they are better than any possessed by other countries—full credit must be given to the pilots who fly them. Theirs is not a fight against long odds once a month but against huge odds several times a day.

GERMAN RADIO EQUIPMENT

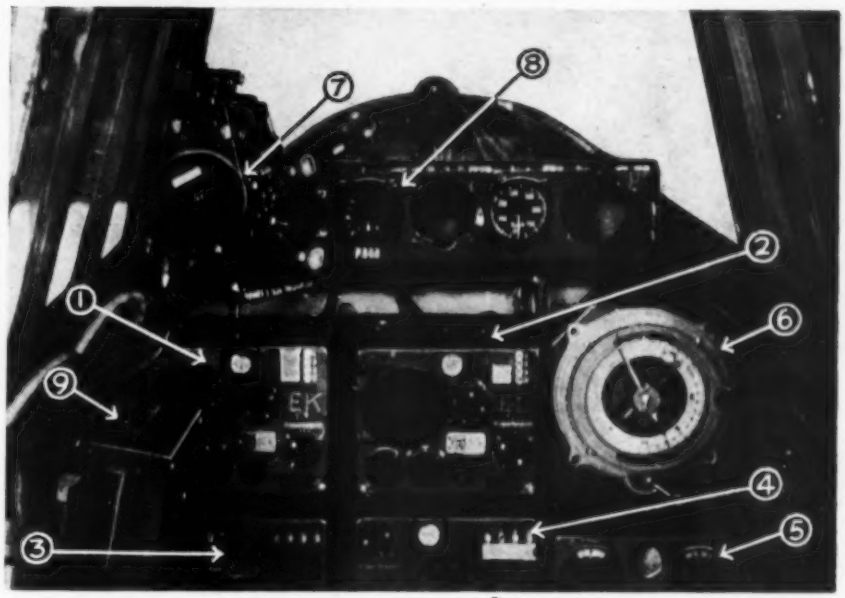
Two Types of Standardised Equipment : Small Frame Aerial

ALTHOUGH soundly designed and constructed, there is nothing in the radio apparatus of captured enemy aircraft to indicate that the Germans are in any way ahead of us in wireless technique as applied to aviation. An inspection of the radio apparatus found in the shot-down enemy aeroplanes soon made this evident.

In the case of the fighters, the apparatus was described in the Me 109 article, but will be briefly repeated here to save reference.

It is, as one would expect, of the simplest possible type, since the pilot already has his hands full with other duties, and wireless operating must be reduced to the absolute minimum. There is a single waveband transmitter and receiver capable of being continuously tuned between 2.5 and 3.7 megacycles. In actual practice this receiver is adjusted to the desired tuning point before the pilot takes off, and is not thereafter adjustable in the air. The range of this installation, which is stowed away in the fuselage behind the pilot, is thirty to forty miles, and it is primarily intended for telephonic communication with the ground.

The case is very different where bombers and fighter-bombers are concerned, and radio forms a large and important part of the equipment. The installation used in the Me 110, He 111K and Ju 88 has been standardised, and is known as the F.u.G.10. Its weight is 358 lb., which is a very considerable amount. Being built on the unit system it is possible to install it in different aircraft according to the disposition and requirements of the pilot, navigator and radio operator.



Layout of radio units in the cockpit of the Me 110. (1) and (2) Receiver units for 3 to 6 megacycles and 300 to 600 kilocycles respectively. (3) and (4) Transmitters covering equivalent wave ranges. (5) Selector unit for operating remote control aerial matching unit in tail. (6) Master compass repeater (white dial) with superimposed loop bearing indicator. (7) DF system selector switch and receiver control unit. (8) Blind approach indicator which may also be used for homing on medium or long wavelengths. (9) Intercommunication amplifier switch box.

Frequency Selection

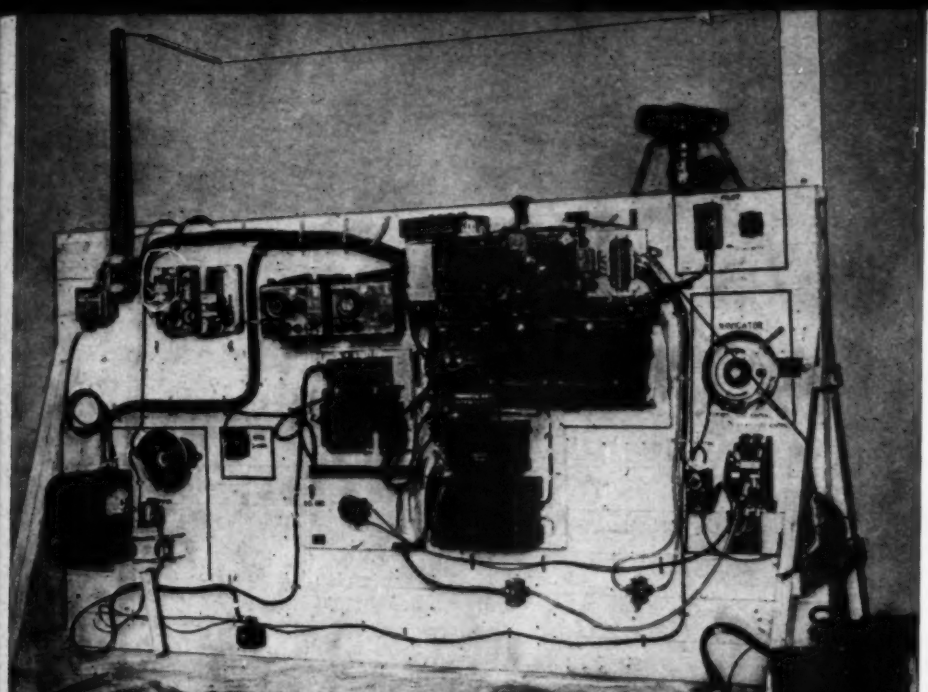
Some of the units of the installation, such as the HT motor-generator, the DF receiver and its frame, the blind-approach receivers and the aerial matching unit, are placed in the tail, but the main transmitter and receiver are mounted very compactly on the instrument board. Continuous tuning is possible over both long- and short-wave bands, but four pre-set frequencies are available in much the same manner as the stations in the push-button broadcasting receiver. These spot frequencies can be aligned with the desired ground stations while in the air.

The 65-watt output from each transmitter is fed through a low-impedance transmission line to the aerial-matching

Extensive use of die casting in the construction of the transmitter and receiver chassis ensures good frequency stability under flying conditions

(Right) The DF loop is of unorthodox design. Its compactness is achieved by the use of a powdered iron core.

GERMAN RADIO EQUIPMENT (CONTINUED)



The F.u.G.10 radio equipment makes an imposing array when removed from the aircraft. Subdivision into small units facilitates the work of installation in machines of different type.

unit in the fuselage. Continuous wave telegraphy is mainly used, but telephony can be employed by bringing into use the intercommunication amplifier for modulation purposes. Magnetically operated switches enable either a fixed or a trailing aerial to be connected up. The fixed aerial is attached to a hollow streamlined spar of bakelised laminated construction, which also houses the vertical rod for the Lorenz approach-beam receiver. The dipoles for the marker beacons are fixed to the underside of the fuselage.

One of the most interesting features of the installation proved to be a very compact frame aerial of entirely unorthodox design. Although its average diameter was only 3 inches, its efficiency is not far short of that of the conventional type of large-diameter frame. This is achieved by using a massive powdered-iron core of oval section about one foot long. This core is surrounded by sectionalised windings placed at intervals along it. Owing to its extreme compactness it is able to be housed in a comparatively small "bulge" on the outside of the fuselage.

This article on the communication equipment of the ***Luftwaffe*** *is the sixth of the "Enemy Aircraft" series and has been preceded by:*

I	*Modern German Bomber* ..	*Ju 88*	*October 3*
II	*The Messerschmitt Me 110*	*Me 110*	*,, 10*
III	*Germany's Dive Bomber* ..	*Ju 87*	*,, 17*
IV	*Nazi Fighter*	*Me 109*	*,, 24*
V	*An Inverted Vee Engine* ..	*DB 601A*	*November 7*

DF Systems

Three systems of DF can be employed, the ordinary figure-of-eight polar diagram of conventional design for general use, a cardioid response for DF or homing, and a visual system. This latter is achieved by rectifying the signals usually heard in the headphones and applying them to the visual indicator of the blind-approach apparatus. This enables the pilot to talk with the crew on the intercommunication system, and simultaneously keep an eye on his course.

The frame aerial of the DF system is rotated by a small handle under the compass on the instrument board and the bearing of the frame aerial can be read on this dial. Also on the dial is a "repeater" reading of the master magnetic compass installed in the rear of the fuselage, so giving the pilot two items of navigating information both in the same place. The "repeater" compass dial will be the subject of a drawing in the article on the Heinkel He 111K.

Only two types of valve are used throughout, one receiving and one transmitting. The former is a special pentode valve (type RV12P) which can be used for all purposes. It has side contacts and fits into an inverted type of valve holder.

The best of materials have been utilised in the construction of the apparatus, and in particular the alloy chosen for the spring contacts in switches and connector plugs is non-oxidising and has excellent fatigue characteristics.

The trend towards die-casting has been allowed full play, and the body of each receiver and transmitter is an intricate honeycombed structure involving machining in three planes. Separate compartments are provided for each valve and tuned circuit, and, wherever possible, the wiring is laid in channels formed in the body of the metal. Even the vanes of the tuning condenser are formed as an integral casting.

Rigidity of construction is extremely valuable in achieving a stable operating frequency under flying conditions, and the performance of German equipment in this respect is in every way satisfactory. The use of temperature-compensated condensers is also a contributory cause, and has enabled the requisite stability to be obtained without crystal control.

The price paid for rigidity of construction is lack of flexibility in design, and it is difficult to see how technical advances can be incorporated in existing receivers. As a consequence, many improvements must be held up until the accumulation justifies radical alteration of the chassis and the cost of cutting new dies.

A portable transmitter for use in the emergency rubber boat was also seen. It is believed that this was not developed particularly for the *Luftwaffe*, but was in use on airliners before the war. Our illustration, given on page e of this issue, shows the set, with its alternative aerials of umbrella type or of wire held aloft by kite. The set gives out automatically a continuous SOS on a wavelength of 600 metres, which is the internationally recognised distress wave. It can also be used to send morse, a key being provided underneath a sealed rubber cover to prevent the entrance of water. The whole of the set has been designed to be watertight within its metal case.

Only one type of valve is used throughout the receiver and intercommunication amplifier units. It is a pentode with a ring seal which can be connected in a variety of ways, and is suitable for all frequencies.

THAT LONG-RANGE BOMBER

"It's Never Too Late To Mend—Or Is It?"

By NOEL PEMBERTON-BILLING

IN accepting the Editor's invitation to supply drawings and specification of an aeroplane to fulfil the requirements laid down by Capt. Macmillan in *Flight* of October 31st, I appreciate that the task is one that may provoke "The laughter of fools and the cackling of hens." In proving it possible I trust that I am straining the imagination rather than the credulity of those who are responsible for deciding our air policy.

It may interest Capt. Macmillan to know that a flying-scale model to my design of an aeroplane capable of this performance is at present nearing completion at the works of F. Hills & Sons, of Manchester. Incidentally, I would like to take this opportunity of expressing my appreciation of Mr. W. R. Chown, the managing director of that firm, for the enthusiastic co-operation which has rendered possible the construction of this machine without official assistance despite wartime difficulties. I would also like to mention the able assistance of Mr. C. R. Tennant, who has been responsible for all the calculations, and to several prominent technicians who have confirmed my claims.

WHEN, in a recent issue of Flight, *Capt. Norman Macmillan laid down his ideal specification for the long-range bomber of the future—five tons of bombs for five thousand miles at 400 m.p.h.—we little expected that the challenge to the industry to attain this performance could be answered within five or even ten years. But Mr. Pemberton-Billing has come forward to show us how, in his opinion, it can be done immediately.*

At our invitation he has written two articles, the first describing an aeroplane that fulfils the specification, and the second the method by which it can be successfully launched into the air. He has requested that, before publishing the latter, we should submit it to the Air Ministry to ascertain whether they still consider its importance to the country insufficient to justify it remaining secret. If they do, this second article will appear in next week's Flight.—*Ed.*

Let me admit, in the first instance, that the attaining of this apparently fantastic performance is rendered possible only by assisted take-off. A detailed and illustrated description of the method will, subject to the Air Ministry's permission, appear in next week's *Flight*. Here and now I propose to describe only the aeroplane itself.

When one surveys the specifications of existing bombers, or even the most optimistic estimates of projects yet to leave the drawing board, there does appear to be some excuse for the reader who begins this article in an incredulous frame of mind. The most efficient bomber yet in service carries one ton of bombs for 3,000 miles at a cruising speed below 200 m.p.h. Newer types not yet in service may be able to double this bomb load and add 50 m.p.h. to the cruising speed, but that is still a long way below Capt. Macmillan's demand in all three of its requirements—load, speed and distance.

A bomb load of 10,000 lb. is more than our biggest bombers can lift, even for the shortest useful range; a distance of 5,000 miles is as far as they can fly even with no bomb load and a favourable wind; a cruising speed of 400 m.p.h. is 30 m.p.h. above the *maximum* speed of our fastest fighter, and approximately 200 m.p.h. better than the cruising speed of our best bombers.

Long-Term Policy

There appears to be an ever-increasing group whose fear for the immediate future is such that the devotion of even half of one per cent. of our man-hours to anticipating the enemy's developments is more than they can spare for technical progress. But Mr. Churchill, in his most recent speech, has told us that we must budget not only for 1941, but for 42, 43, 44. Surely that is time enough for far-reaching developments in design. Both the Premier and the Minister of Aircraft Production share that invaluable characteristic of imagination which should indicate an insistence that ideas that can attain the backing of responsible scientists, as distinct from officials, shall at least be tried. The efforts to increase performance by minor improvements to orthodox design now taking place is very rapidly reaching its upper limit.

While I feel that the principles I advocate here would do much to bring the war to a successful conclusion, in my view they must be taken as no more than a stepping-stone to further and more ambitious efforts. The limits of speed that can be obtained by simply attaching a propeller to an engine are rapidly approaching. The submerged power plant with remote drive is the only way of postponing the compressibility shock wave. In fact, so wedded am I to this development that I have embodied it, against the "better judgment" of many of my expert friends, in the prototype at present under construction in Manchester. In this case two low-speed trailing edge propellers are driven by a high-speed shaft from a normally revving engine through a gear box with two speeds and reverse. The engine is completely enclosed in the centre fuselage behind the pilot, thus combining exceptional visibility for the pilot with the highest possible aerodynamic efficiency.

I do not wish this application of my principle to Capt. Macmillan's demands to suggest that I am in any way departing from the opinion that I have advocated since 1914: that the true function of a bomber is that of a long-range gun of enormous calibre. This naturally presupposes the principle of one big bomb, one big engine, and one small man; and may I reiterate once more that *the only effective protection for a bomber is speed*, not armament. It is not the business of a bomber to get mixed up in a dog fight any more than it is the business of a messenger boy to watch one. A bomber which bombs and runs away lives to bomb another day. Let me reiterate another statement that may, at first, appear startling, and this I make bold to predict will hold good for all time, because it is based on natural laws: that, as the requirements of a bomber do not include manœuvrability or armament, which are the first essentials of a fighter, it will always be possible to build a bomber at least fifty m.p.h. faster than a fighter.

Colossal or Competent?

Bearing all this in mind, and even allowing for the imagination so noticeable in contributors to the non-technical Press and so unnoticeable in the technical official, it would appear that at least they share one belief in common; that the salvation of the country lies in the "flying fortress." It would indeed be a tragedy if this prejudice for the colossal, as distinct from the competent, should be responsible for the elimination of our Empire, even as the Spanish Empire was lost through their faith in the "floating fortresses" of the Great Armada. But I digress, or do I?

To mention a wing loading of 90 lb./sq. ft. which I now propose to develop is as shattering to the official mind of to-day as the mention of 30-40 lb./sq. ft. was to the same official mind twenty years ago, when 8 lb./sq. ft. was considered recklessly unorthodox. And this despite the fact that any earnest student of aerodynamics must be aware that, all other conditions being comparable, if an aeroplane can take off and reach its operating height at 30 lb/sq. ft. loading, it can most efficiently proceed on its journey with one-third its wing area, i.e., 90 lb./sq. ft. loading. In other words, *the gross weight of the aeroplane can be multiplied by three without increasing its size.*

THAT LONG-RANGE BOMBER (CONTINUED)

As the secret of successful bombing is heavy load and high speed, one may well wonder why this line of thought has not excited the official mind. It is no defence to say that past experiments with assisted take-off have proved impracticable for war conditions. If I may for a moment descend to Parliamentary phraseology, I might suggest that it must be expected to "take all necessary steps," "leave no stone unturned," "explore all avenues" and "last but not least," "read, mark, learn and inwardly digest" the Official Organ of The Royal Aero Club before finally depriving this country of this inestimable advantage. But again I digress, or do I?

And now let us consider, in non-technical terms, the admirable requirements of Capt. Macmillan's specification. First of all, to the possible surprise of the Captain, I submit that it may be done not ten or twenty years hence, but to-day, *using existing engines, existing materials and existing methods of construction*, our only obstacle being the *existing official mind*.

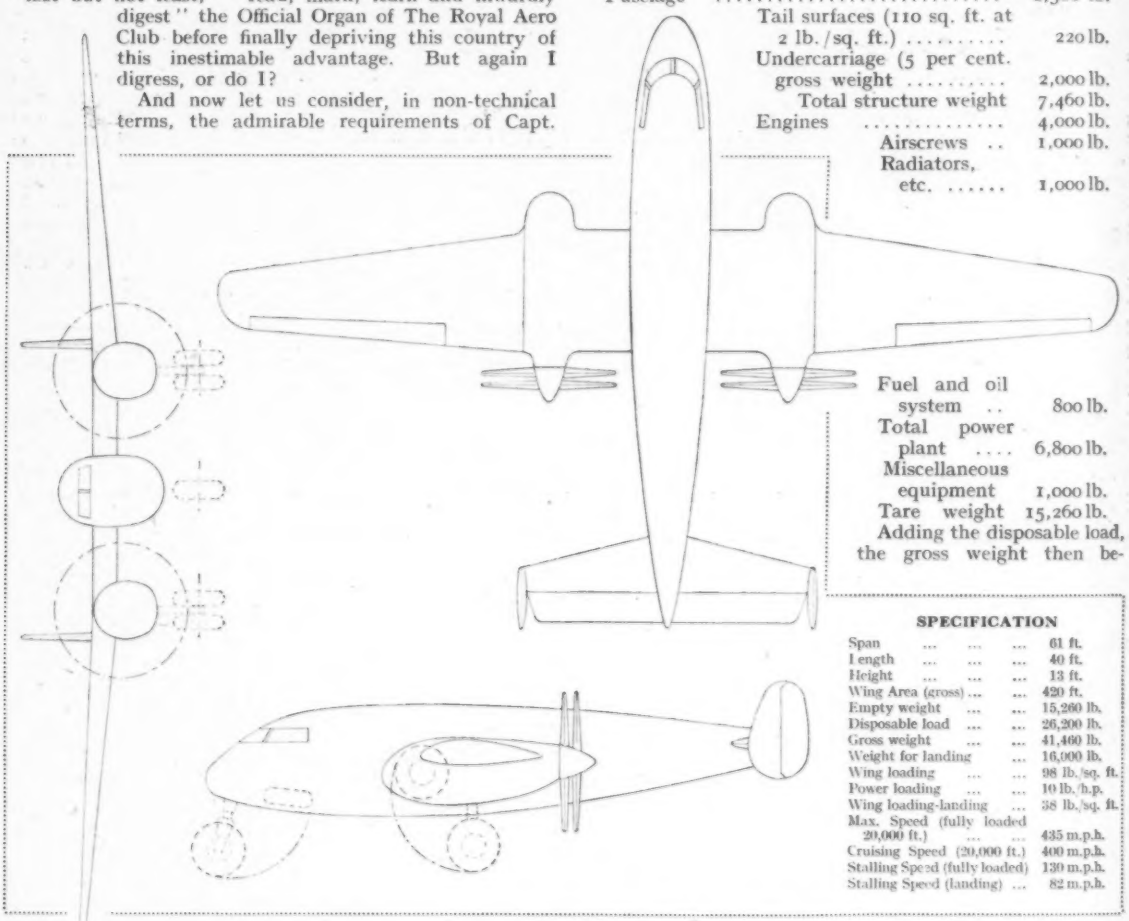
Assuming two liquid-cooled engines of the largest type at present in existence—2,000 h.p., and a wing loading of 98 lb./sq. ft., which would be reduced to 32 lb./sq. ft. for take off and 39 lb./sq. ft. for landing, the following specification is obtained. (It has been assumed that the aeroplane is on conventional pusher lines, with outboard engines and central fuselage. Such necessary and inevitable developments as buried engines and shaft drive would enable a considerable further increase in performance.)

The bomb load is 10,000 lb. A range of 5,000 miles at 400 m.p.h. cruising means a duration of 12½ hours. Assuming a mean cruising output of 1,350 h.p. per engine and a consumption of 0.43 lb./h.p./hr., 14,000 lb. of fuel will be required, and, say, 1,000 lb. of oil. Allowing for a crew of three and 500 lb. of coolant, this makes the total disposable load 26,200 lb.

The wing area necessary is only 420 sq. ft., so that it is quite a small aeroplane, less than half the size of a Wellington. The tare weight has been estimated as below. The structure weights may appear low compared with the payload, but existing proportions are entirely upset by the efficiency of high wing loading. Considered in relation to the size of the aeroplane, they are conservative.

Wing (420 sq. ft. at 7 lb./sq. ft.)	2,940 lb.
Fuselage	2,300 lb.
Tail surfaces (110 sq. ft. at 2 lb./sq. ft.)	220 lb.
Undercarriage (5 per cent. gross weight	2,000 lb.
Total structure weight	7,460 lb.
Engines	4,000 lb.
Airscrews	1,000 lb.
Radiators, etc.	1,000 lb.
Fuel and oil system	800 lb.
Total power plant	6,800 lb.
Miscellaneous equipment	1,000 lb.
Tare weight	15,260 lb.

Adding the disposable load, the gross weight then becomes 41,390 lb. For landing this is reduced to 16,000 lb. by the using up or jettisoning of the fuel and bombs, making the loading for landing 38 lb./sq. ft. This means a stalling speed lower than those now associated with the tricycle undercarriage, for which loadings up to 40 lb./sq. ft. are now considered reasonable and within the limits of war aerodromes.



SPECIFICATION

Span	61 ft.
Length	40 ft.
Height	13 ft.
Wing Area (gross)	420 ft.
Empty weight	15,260 lb.
Disposable load	26,200 lb.
Gross weight	41,460 lb.
Weight for landing	16,000 lb.
Wing loading	98 lb./sq. ft.
Power loading	10 lb./h.p.
Wing loading-landing	38 lb./sq. ft.
Max. Speed (fully loaded 20,000 ft.)	435 m.p.h.
Cruising Speed (20,000 ft.)	400 m.p.h.
Stalling Speed (fully loaded)	130 m.p.h.
Stalling Speed (landing)	82 m.p.h.

Here is the bomb load that Captain Macmillan requires. Can the speed and distance also be obtained? The total drag at sea-level is estimated to be 207 lb. plus induced drag, made up as follows:—

Wing profile drag, 75 lb.; fuselage, 70 lb.; tail surfaces, 25 lb.; nacelles, 27 lb.; interference, 10 lb.

The equivalent induced drag for cruising varies from 75 lb. at the commencement of the journey to 13 lb. at the end. The maximum speed at 20,000ft. on 4,000 h.p. is then 435 m.p.h. fully loaded, rising to 460 m.p.h. after reaching its objective. For a cruising speed of 400 m.p.h. at 20,000ft. the power required when fully loaded will be 3,100 h.p. After 2,500 miles, the reduction in weight due to the consumption of fuel reduces this 2,750 h.p. After dropping the five tons of bombs it is further reduced

THAT LONG-RANGE BOMBER (CONTINUED)

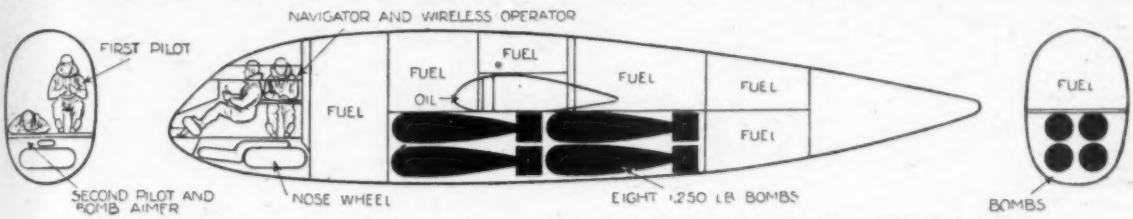


Diagram showing how it is proposed to stow bombs and fuel in the Pemberton-Billing long-range bomber.

to 2,500 h.p., and at the end of the homeward journey, with all the fuel used, it becomes 2,340 h.p. This makes the fuel required for the outward journey 7,800 lb., and that for the return 6,450 lb., making up the total of 14,250 lb. Capt. Macmillan's specification is thus covered in all its requirements—speed, range and bomb load.

The speed of 400 m.p.h. is desirable when over enemy territory, but if it is permitted to cruise at a lower speed when out of danger, the range would be increased to somewhere around 8,000 miles by careful manipulation of speed and power output to keep the induced drag fairly constant at its optimum figure; or alternatively, more bombs could be carried for the same range.

20,000 lb. for Berlin

Although this range might be useful if ever we are forced to transfer our war operations to bases in Canada, most of our present targets are within 200 to 1,000 miles of this country. For distances such as this, tank space could be replaced by bombs, and up to 20,000 lb. of explosive could be carried to Berlin, or 16,000 lb. to Rome.

These figures are based on a maximum wing loading of 98 lb./sq. ft., as this is considered as high as it is reasonable to venture at the present. Preliminary tests can be made in light condition at 40 lb./sq. ft. loading and the weight gradually increased.

To improve these figures substantially, we are driven to the adoption of the submerged power plant installation along the lines on which I am now experimenting at Manchester. And here I would like to express my thanks to Mr. F. M. Aspin, whose revolutionary rotary-valve engine is now beginning to achieve the recognition it deserves, for his assistance in connection with this unorthodox installation in the experimental machine.

There is no theoretical reason why loadings should not go even higher, and, indeed, no apparent practical reason. If the design is inherently correct, merely increasing the loading should not affect the stability, though it does, of course, reduce manœuvrability and increase stalling speed. It greatly reduces the effects of gusts and bumps. Research made by Lockheed Aircraft shows that danger from icing is reduced rather than increased by increase in loading.

It may therefore prove possible to increase the loading to the theoretical optimum, which in the present design could exceed 100 lb./sq. ft. if it were flown at full throttle at the commencement of the journey, making possible still further increase in range or bomb load.

To conclude, may I say that although I have been intermittently developing this principle since 1912, when I took out my original patents (*vide* the technical Press of the period), this is the first time since the outbreak of the war that I have put pen to paper on this subject.

In January, 1916, in response to an urgent request from the Editor of the *Daily Mail* (while a raid was in progress) to provide him with an article for the following morning on the inadequacy of our defence from night attack, I began that article with the words, "As I write, the bombs are falling. England is once more under siege." As I write to-night, the same applies, but they are bigger and better bombs.

PROGRESS in RESEARCH

Vibration

FLIGHT tests of the Lockheed Lodestar revealed excessive vibration in the cabin. Exhaustive tests proved beyond a doubt that the source of the vibration was aerodynamic in nature, specifically, an interference condition between the airscrew slipstream and the stabiliser. Surveys of the flow at the tail indicated that at cruising engine speeds, in level flight, the slipstream just bordered on the horizontal stabiliser and created a vibration in the tail unit which was transmitted into the fuselage. Various changes were made in the aeroplane in an attempt to remedy this condition and finally, by elevating the tail unit one foot above its previous position, the vibration was entirely eliminated.

Effects of Airscrew Slipstream and Tail Position on the Vibration Characteristics of the Lockheed Lodestar. (R. L. Thoren, C. L. Johnson, J. Aeron. Sci., Vol. 7, No. 10, Aug., 1940, pp. 419-421.)

Noise in Flight

OBSERVATIONS and measurements of noise in the high-speed wind tunnel at the National Physical Laboratory show that the noises can be classified into three main classes. Class A consists of rushing noises similar to those produced by the empty tunnel, which can be considerably reduced by using ordinary acoustic absorbents, or rendered unobjectionable to the experimenter by wearing special ear plugs.

Noises of class B are whistling sounds of high but very definite musical pitch, occurring at any speed below the shock-stall, and causing the greatest annoyance. It is found that this class of noises may be entirely eliminated by roughening the surface producing them. The singing noise made by exposed streamline wires on some aeroplanes could probably be eliminated by the method of surface roughening described in this report.

Class C noises occur on sections having a thickness greater than 15 per cent. of the chord, at about the shock-stalling speed. The noise is very loud (110 to 120 decibels), relatively low-pitched, and only partially silenced by roughening the surface.

In addition, observations are recorded on the effects of material (none), scale (small effect), incidence (small effect), thickness (pronounced effect on class C), and on sharp leading and trailing edges (marked effect on class B).

Measurements of the Noise from Aerofoils and Streamline Wires (W. F. Hilton, Phil. Mag., Vol. 30, No. 200, Sept., 1940, pp. 237/246).

Wing Covering

THE German aeronautical experimental centre has patented a new process for the covering of wing surfaces. This covering, which is perfectly water and air tight, consists of a metal fabric between two layers of compressed synthetic resin. For example, using a metal fabric with a weave of 50 to 120 meshes per sq. cm., spun with a 0.12 mm. wire, a covering is obtained with a resistance of 2,000 to 3,000 kg. per metre, for a unit weight of 600 gm. and thickness of not more than 0.25 mm.

New Covering for the Wing Unit of Aircraft. (L'Ala d'Italia, 16.30.6.40, p. 51.)

(Abstracts prepared by R.T.P. and made available by courtesy of Ministry of Aircraft Production.)

DOMINION at WAR

Canada to Build Aero-engines : Airframe Production Increases : Civil Flying Expands : R.C.A.F. Patrols on Pacific Coast

CANADA has taken one more important step toward self-sufficiency in the production of war weapons and supplies, for aero-engines will be built there, so that Canadian defence forces will not be so dependent on supplies from Britain and the United States. When the new plan is established, Canada will be able to ship complete aircraft to Britain.

Negotiations are now under way with an English firm to obtain the rights and drawings for a British engine. Skilled craftsmen will be sent to Canada to supervise the construction of a plant and the engines, but the bulk of the factory workers will be Canadian. The Government has not disclosed where the plant will be located, nor the type or types of engine.

Canadian Car and Foundry Co., Ltd., has received through British and Canadian purchasing boards an initial order for 1,500 airscrew hubs and approximately 1,000 airscrew shafts. The hubs are of the two-position controllable-pitch type.

At the present time various factories in Canada are constructing eleven different types of aeroplanes, most of which can be used for military purposes. They include the Anson, Bolingbroke, Hampden, Hurricane, Lysander, Stranraer, Harvard, Fleet 60, Norseman, Tiger Moth and Fleet Finch.

Training Plan Pilots

It is understood that Canadian factories have started work on the new four-engined British Stirling bombers. Production of twin-engined Handley Page Hampden bombers will soon reach 15 monthly, according to Paul F. Sise, president of Canadian Associated Aircraft, Ltd., the central assembly organisation.

W. J. Sanderson, president of Fleet Aircraft of Canada, who since the start of the war has headed the Aircraft Construction Division of the Canadian Ministry of Munitions and Supply, resigned from that post at the beginning of October because of the increasing demands of his own business, which is producing trainers for the Canadian Government.

"Mr. Sanderson first came to the Defence Purchasing Board in September, 1939," said Mr. Howe, Minister of Munitions and Supply, "to head our aircraft division. He it is who conceived and brought to fruition the entire Canadian aircraft manufacturing programme which is now day by day increasing the effectiveness of the Empire air arm. We are deeply grateful to him for his efforts and for the excellence of the results which he has obtained."

The first large group of fighting pilots trained under the British Empire Air Training Plan was graduated on September 30 at Camp Borden, Ontario. The group contained pilots from all parts of Canada, U.S.A. and the West Indies.

Under sponsorship of the R.C.A.F., a junior organisation of air cadets among boys of 15 and 16 years of age is being set up all over Canada. The corps is being organised to provide for the training of air cadets to fit into the British Commonwealth Air Training Plan, and boys undergoing training will be given preference when signing up with the R.C.A.F. on their eighteenth birthday. The air cadets will wear a uniform somewhat like that of the R.C.A.F. Financially, the corps will be entirely self-supporting.

Air Transport

A civil aviation report of the Department of Transport for the first six months of 1940 shows that on June 30, 1940, there were in Canada 761 private pilots, 153 commercial pilots, 244 limited commercial pilots, 142 transport pilots, 762 air engineers, and 22 airport traffic control officers. At that time there were in use 64 private aircraft, 443 commercial aircraft, and 103 airports were licensed. Private flying clubs during the first half-year flew 21,518 hours with 104 aeroplanes, surpassing in that half-year every full year except 1939. There were 2,261 members in the 21 clubs located throughout Canada, 773 of whom were under instruction. Private pilot certificates were awarded to 91 members during the first six months, commercial certificates to 17.

Trans-Canada Air Lines, the transcontinental airline, has been given the right to fly from Toronto to New York. This gives Canada a 15-hour service from New York to Vancouver against 16- and 17-hour services from New York to the Pacific coast provided by United States lines with present equipment. T.C.A. carried nearly three times as many passengers during the first eight months of this year as in 1939.

Canada's Largest Hangar

The new Trans-Canada Air Lines hangar now under construction at Montreal's new airport at Dorval will be the largest hangar ever erected in Canada as one unit. While the Winnipeg hangar has the same dimensions, it was first built with a width of 100ft. and later enlarged. The Dorval hangar will be 200ft. wide by 150ft. long and 27ft. high. Its door opening will be 190ft. wide, and the doors, electrically operated, will be opened and closed in a matter of seconds, either as a complete unit or in sections. A concrete apron 200ft. square will be laid in front.

T.C.A. expects to have the hangar ready for occupancy by July 1 next year. The Department of Transport is laying out runways and erecting an administration building. As a commercial airport, Dorval will replace St. Hubert, which will be taken over for war purposes.

At the rear of the hangar, which will be of steel and brick construction, will be built an annex, the full 200ft. wide by 50ft. This will be used for stores and repairs, and it is so designed that another storey may be added to it. Special provision will be made in the trusses of the main building for hoisting equipment.

The Coastal Command

Little is heard of the Western Air Command of the R.C.A.F., which has the patrolling of the Pacific Coast among its duties. It is a rugged, mountainous, deeply indented coast bordered by the thousand-islands barrier protecting a large part of the mainland. The shore line of coast, inlets and islands totals more than 6,000 miles. The "flying mariners" who man the reconnaissance bombers absorb their marine knowledge at the Jericho Beach station during a session of eight weeks.

Instruction in the theory and practice of navigation, including celestial navigation, is given. Radio work also plays an important part. Other subjects are signalling, coding, ship recognition, lights and buoys, ropes and knots, tides and currents, and lastly sailing. Ship recognition is particularly important if convoy protection is to be effective, as the identity of friend or foe must be established quickly.

There are seven bases from which the patrols leave, and three of them are very remote. Ucluelet, on the west coast of Vancouver Island, is washed by the boiling surf of the Pacific, while Coal Harbour, on the same island, is in a deeply cut fjord. Alliford Bay is in the extreme north on the Queen Charlotte Islands, "where it rains," and the heavy mists pile up the mountain-guarded channel. And near Prince Rupert is another base from which the patrols range out over the long ground swells of the open ocean. They are on patrol when westerly gales lash the shores into rearing, seething surf. Fair weather or foul they keep protective watch, whether sunshine caresses the broad blue-green sweep of the Pacific or black storm clouds darken its surface with treachery, draping wisps of murky mist over the jagged tree-tops of the coastal mountains.

HERE and THERE

Not So Hot

A FEW days ago it was reported by the United States Department of Commerce that during September the number of aircraft shipped to the United Kingdom was only 205. The figure for August was more than double, and it has been suggested that this total included large numbers of machines built for France and transferred to Britain.

The Wrong Tree

WE owe an apology to Dr. Ernst Heinkel, and also to the scores of readers who have written to us and pointed out that the photograph on page 365 of our October 31 issue was of a Heinkel He 113 and not a Messerschmitt Me 109. The former machine is, we believe, without the vices of the 109. We knew that readers study our pages carefully, but it was something of a revelation to find that such large numbers took the trouble to write to us. More than one of the letters started with the words "*Flight* is so invariably right that I wonder if," etc. Thanks for the compliment, and for pointing out a slip which, in the stress of publishing in somewhat difficult times, passed into print before being discovered.

U.S. Air Accident

BOUND from California to Salt Lake City, an airliner crashed at Bountiful, near Salt Lake City, very recently. All ten of the occupants were killed. This is the second serious accident in U.S.A. following the long run, previously unsurpassed anywhere in the world, of about seventeen months without a fatality. Air Transport in U.S.A. and all concerned with the accident have the sympathy of *Flight*.

Aeronautics at Sydney University

PROFESSOR A. V. STEPHENS, who was appointed to the chair of aeronautics at the University of Sydney just before the outbreak of war, has now settled down to his work out there. His departure from Farnborough last year was delayed in order to retain him on scientific work. The chair of aeronautics was set up at Sydney as a result of Dr. Wimperis's report on research to the Commonwealth Government after his visit to Australia in 1937.

PEANUT SPECIAL : Although designed as a fighter for the U.S. Navy, the Brewster Buffalo will be employed as a land fighter by the R.A.F. A mid-wing monoplane with a fuselage of a recent American fashion, it is said to be extremely manœuvrable.

Australian Air Court

AVIATION accidents in Australia will in future be investigated by a special Air Court presided over by a judge of a state or federal court, assisted by two assessors, one of them an airline pilot and the other an official of the Civil Aviation Department. Enquiries into charges of incompetence or misconduct on the part of aviation officers, with power to suspend licences or certificates, comes within the scope of the court's duties.

Carrying On

ALTHOUGH little is heard of their activities, the Olley group of companies is doing considerable air transport work. At the expiration of the National Air Communications duties at the end of April the group associated itself with the railways group, and it has been operating regular air services to and from Dublin in association with Aer Lingus Teoranta, and still operates under the title of West Coast Air Services, Ltd. Air Commerce has transferred its activities to the Olley group and now overhauls the engines of all companies within the group. The Isle of Man air services continue to run several times a day, and it will be of interest to readers to know that the London office of Olley Air Services is retained at Lower Belgrave Street for enquiries.

Empire Air Fares

WHAT with the "horseshoe route" wandering about the world, it costs some money to travel from Australia to England by air these days. The Sydney-Alexandria stage costs £171, and another £118 from Alexandria to Durban makes a total of £289 for the air part of the trip. If you are an Australian, this means you add 25 per cent. and pay in Australian currency the tidy sum of £A361 for your single ticket. Then, having arranged an overdraft, you buy a steamer ticket from Durban to England. The pre-war rate between Sydney and London was £A180. The Sydney-Calcutta fare, previously £A115, is now £A128.

INTELLIGENT ANTICIPATION : Major Gen. B. K. Yount and Major Gen. J. F. Chaney of the U.S. Army Air Service are here to watch the *Blitz* officially.

Record of Test Flight Data

THE Lockheed Aircraft Corporation has adopted an instrument which has been invented by Herman S. Heller, of Los Angeles, for the purpose of recording quickly the data which are collected during a test flight. To minimise flying time, which is expensive, the instrument enables the pilot and observers to speak their readings and observations on to a permanent record instead of slowly and laboriously writing them down. (Photographing the instruments on the board is another way, but this will not always serve.)

The "Planetest Magnograph," as it is called, works electrically by recording the speech in the form of a voltage on a steel tape about ¼in. wide. Sixteen channels of speech may be recorded for one hour or one channel for 16 hours. Later, in the office, the tape is played back again to stenographers.

Since it records a voltage, the device can be used for flutter, vibration and noise investigations, allowing the results to be obtained quickly and afterwards analysed in the laboratory.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

SUB-CONTRACT DRAWINGS

Gavin Starey's Views Supported

I FEEL that Gavin Starey (October 10 issue) should have some support against H. W. E. C.'s rather contradictory remarks on drawing procedure (October 24). Since the last paragraph of the letter is not qualified, the persons who have entered the aircraft industry from the commercial field and have given invaluable assistance in making possible the quantity production of aircraft and aircraft armaments should also be vindicated.

H. W. E. C. states that the suggestion of arranging the design drawings to suit a sub-contracting firm's "particular methods of manufacture could not possibly be agreed to." Gavin Starey merely suggested *amplifying* the drawings and this scheme is quite sound, does not transgress any aircraft or armament design memorandum (in fact, it is recommended in a current A.D.M.) and is frequently used.

All the Air Ministry (M.A.P.) require is a complete set of master design drawings properly dimensioned to ensure interchangeability, etc., and it is these design drawings which are sealed, any subsequent design modifications being regularised through the proper channels and recorded on the master drawings.

The original drawings may be amplified to cater for the different plant and facilities of sub-contractors, and if necessary a separate set of production drawings may be produced and used provided the R.T.O. of the designing firm concurs and the article manufactured satisfies all strength, interchangeability and functioning requirements.

Gavin Starey's conception of a small department to act as a kind of clearing house or central control has many advantages, especially in these days of decentralisation of the larger firms. The idea is indeed being adopted by at least one well-known firm.

It would appear that H. W. E. C. has not been engaged in commercial enterprise—neither has the writer—but fifteen years' experience in the aircraft industry has not bound him so tightly to Air Ministry procedure that he cannot appreciate the help given and profit by the experience of the commercial engineer who has given the "prod" to production.

Gloucestershire. K. T. P.

ASSISTED TAKE-OFF

The Question of Water Drag

MR. TENNANT states that an aircraft carried upon my hydroplane-launching gear cannot be considered in analogous condition to a twin-float seaplane because, in the latter case, the water resistance diminishes as the craft becomes airborne and becomes zero as the machine takes off. For this reason he considers that my device would not attain the speed necessary for take-off with high wing loading.

It is true that the water drag of the hydroplane does not become zero because the hydroplane does not leave the water, but the major proportion of the load—the weight of the aircraft—is removed from the water in the same way as for the seaplane and, in fact, is removed earlier in the run as the aircraft can be trimmed back to a high incidence without altering the trim of the floats. This effect is greatly accentuated by positioning the hydroplane airscrews immediately behind the wings of the aircraft so that the inflow induces lift. A large proportion of the wing is affected by the slipstream and this induces lift, the effect being greatest at low speeds, and so far from the consequent reduction of loading being, as Mr. Tennant states, negligible, a large proportion of the load would be airborne from the commencement of the launching run, and hence the "hump speed" passed and the planing condition established earlier.

I have already pointed out that the floats may be designed purely for water performance. This means that a flat planing surface, broad at the step, could be used. Such floats would show a considerable reduction in resistance as against the orthodox vee-bottomed float, and the efficiency of this type increases with speed owing to the better aspect ratio of the planing surface as the hull rises.

Besides the reduction in water load and resistance as compared with the seaplane, the power available may be more than trebled at a cost in weight only of the extra power units and the flotation gear. The thrust/weight ratio and consequently acceleration is thus greatly improved. These considerations lead me to believe that the water performance of the launching device might be superior to any seaplane.

In regard to Mr. Tennant's estimate of the stalling speed of the Schneider seaplane, I would point out that a seaplane does not take off at this speed, but is usually accelerated to a speed perhaps 20 per cent. higher on the water. During this period the incidence is held down to the best running angle of the floats, and hence they are still bearing weight. As a final concession to Mr. Tennant's doubts on this issue, I would point out that it would be perfectly easy to provide surfaces on the floats to give additional aerodynamic lift.

It seems obvious that the motor-boat speed record could be exceeded by an airscrew-propelled hydroplane of suitable design, since the planing efficiency could be at least as good, the propulsive efficiency much better than with the water screw, and the weight per h.p. of the engines better also. I cannot comment on the Italian twin-hulled airscrew-propelled boats quoted by Mr. Tennant, because I have never heard of them. I should greatly appreciate references on this point.

To the further points raised by Mr. Tennant, I would state that a "composite" or other form of auxiliary aircraft appears just as likely to experience engine failure near the ground as any other type, in which case there would be no time to jettison fuel. It would appear better to employ a type capable of alighting safely at high speeds. In the first paragraph of my article of July 4 I specifically excepted the bomber and the long-range machine from the general statement that it is the alighting case which sets the limit to wing loading. All the proposals hitherto put forward for assisting take-off have been confined to these two classes because of the landing difficulty. My proposals would enable aircraft to take-off and to alight safely with high wing loading.

I await with interest publication of the scheme mentioned by Mr. Tennant. F. W. KING.

New Malden.

SOUND LOCATING IN THE AIR

The Microphone Problem

YOUR correspondent B. P. Foley raises a question which must have arisen in many people's minds, namely, the possibility of utilising sound-locating apparatus for finding enemy aircraft at night from a plane in motion. The reference to the loop aerial needs clarification, for although your correspondent undoubtedly realises the difference between sound and radio radiations, the majority imagine that the transmission medium is the same.

Sound radiations are transmitted by the collision of air molecules, each conveying the initial energy with diminishing amplitude of motion until some time when the motion is below audibility. Radio transmissions, on the other hand, do not rely on air as the transmission medium but on the ether.

Various systems of sound-locating apparatus have been tried with varying success, but certain problems are still awaiting solutions. One of the major problems lies in the design of suitable microphones. These must be located away from the engine noise, and one possible position would be at the extreme ends of the leading edge of the wings. The wind pressure must be balanced out, but this can be done by the use of duplicate sound paths, one to the front of the diaphragm, and the other to the rear, with a suitable attenuation unit to eliminate the desired sound component from either the front or rear of the diaphragm. The output from the microphones could be fed to balanced amplifiers, which in turn could operate some suitable indicator apparatus such as a cathode-ray tube.

By the phase and amplitude differences of the incident sound waves the searching plane could be directed until the output from each microphone is identical, when the enemy plane should be found immediately ahead.

The wave form of the exhaust note of the plane's engine is a very complex one, having a very low fundamental component in the order of 15 to 25 c.p.s. and a large harmonic series extending to the order of 5,000 c.p.s. Due to the fact that the higher frequencies tend to travel in relatively straight paths, it would appear that suitable frequency filters should be incorporated whereby the operator uses the whole of the audible spectrum for his initial readings and then gradually eliminates the lower-frequency range until he relies entirely upon the harmonics for the final bearings.

F/O. JOHN C. G. GILBERT,
F.R.S.A., A.M.I.R.E., A.M.I.W.T.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Empire-trained Pilots

A MESSAGE from Rhodesia states that pilots, who are believed to be the first entirely trained under the Empire Scheme, have passed out as fully qualified from the Cranborne Training School near Salisbury.

At the passing-out parade they were addressed by Lt.-Col. Lucas Guest, the Air Minister.

R.A.F. Pensions

AN Order has been signed by the King regulating the retired pay, pensions and allowances payable to members of the Royal Air Force and all its auxiliary and nursing services.

Officers' disablement allowance ranges from £70 to £350 per annum for an Air Vice-Marshal down to £35 to £175 for a Pilot Officer. The pensions will range between these figures, according to the degree of disability.

The weekly rates for non-commissioned officers and men vary from 46s. 8d.-9s. 4d. for warrant officers to 43s. 2d.-6s. 2d. for aircraftmen. The rate of allowances for dependents of all ranks is also set out. The disablement rates for women in the nursing and auxiliary services of the R.A.F. are included in the schedule in addition to a list of sums payable for specified minor injuries.

Awards

DISTINGUISHED FLYING CROSS.

SQN. LDR. P. J. SANDERS—No. 92 SQN.—Sqn. Ldr. Sanders has commanded his squadron since May, 1940, and his continuous leadership, skill and determination have been responsible for the high standard and morale of the squadron. On one occasion when leading his squadron on an offensive patrol he displayed great skill and leadership and was personally responsible for the destruction of two and probably three hostile aircraft. He has in all destroyed at least six enemy aircraft.

F/O. W. M. SIZER—No. 213 SQN.—During a period of five days in France this officer destroyed one enemy aircraft and shared in the destruction of four others. Since the return of the squadron to this country F/O. Sizer has taken part in a large number of patrols and has personally destroyed at least a further six enemy aircraft. During one patrol he was attacked and shot down by five Messerschmitts. Landing two miles outside La Panne, he swam across a canal and was taken to a casualty station suffering from facial wounds, and thence to England. After only two days' sick leave he again participated in patrols with his squadron.

P/O. J. B. LATTA—No. 242 SQN.—P/O. Latta has destroyed eight enemy aircraft in operations over France and this country. On one occasion his squadron attacked a number of Messerschmitt 109s. This officer destroyed one and, although his own aircraft had been hit in the wings and tail by cannon shells, attacked and destroyed a second enemy aircraft. He has displayed the utmost coolness in the midst of fierce combat.

BAR TO THE DISTINGUISHED FLYING MEDAL.

SGT. R. S. AYTON, D.F.M.—No. 44 SQN.

DISTINGUISHED FLYING MEDAL.

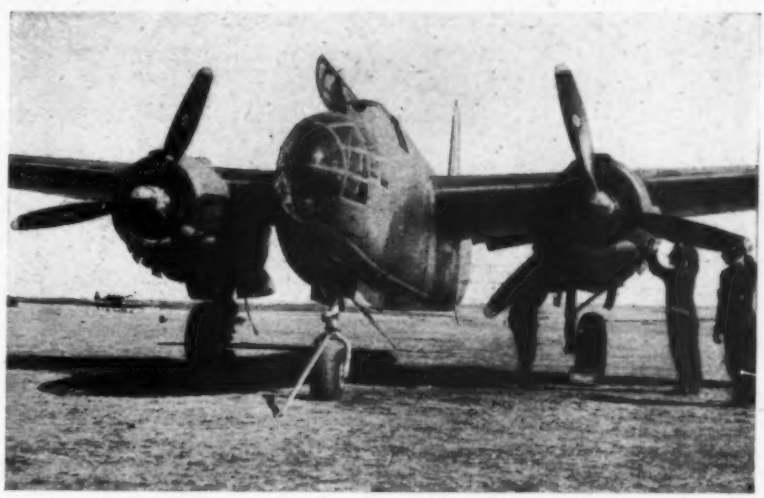
SGT. W. R. J. HALL—No. 44 SQN.—One night in October, 1940, Sgt. Ayton was pilot and Sgt. Hall the navigator and bomb aimer of an aircraft detailed to bomb an important military objective in the centre of the defences of Berlin. On arrival over the target area reconnaissance runs were made until the target was definitely identified in the moonlight. Sgt. Ayton then dived, through intense and accurate anti-aircraft fire, to a height of only 2,000 feet. In spite of the great speed attained in the dive, the skilful bomb-aiming of Sgt. Hall enabled direct hits to be obtained on the target where fires were seen to break out. The courage and determination of Sgt. Ayton in pressing home his attacks under all conditions, and the skill and courage of Sgt. Hall, have been an inspiration to the other members of the squadron.

A.A.S.F. Awards

THE KING has been graciously pleased to approve the following awards:—

DISTINGUISHED FLYING CROSS.

Sqn. Ldr. A. F. Anderson, No. 613 Sqn.; Sqn. Ldr. H. G. Lee, A.F.C.; Sqn. Ldr. D. Walker, No. 615 Sqn.; F/O. J. R. Havers, No. 103 Sqn.; F/O. D. S. G. Honer, No. 88 Sqn.; F/O. R. F. Martin, No. 73 Sqn.; F/O. C. D. Palmer, No. 1 Sqn.; F/O. H. G. Paul, No. 73 Sqn.; F/O. P. H. M. Richey, No. 1 Sqn.; F/O. N. C. S. Riddell, No. 88 Sqn.; F/O. W. H. Stratton, No 1 Sqn.; P/O. A. L. Edy, No. 613 Sqn.



R.A.F.'s FIRST TRICYCLE: Douglas D.B.7 Boston bombers originally ordered for the French Air Force are now coming into service with the R.A.F. The engines are P & W Twin Wasps with a take-off power of 1,050 h.p.

DISTINGUISHED FLYING MEDAL.

Sgt. S. E. Andrews, No. 150 Sqn.; Sgt. L. V. Davies, No. 88 Sqn.; Sgt. N. J. Ingram, No. 150 Sqn.; Sgt. E. D. Martin, No. 150 Sqn.; Sgt. D. Norrington, No. 103 Sqn.; Sgt. W. H. Sturdy, No. 88 Sqn.; Sgt. J. E. Summers, No. 103 Sqn.; Sgt. L. F. Waern, No. 103 Sqn.; L.A/C. C. Cooper, No. 150 Sqn.; L.A/C. H. R. Figg, No. 150 Sqn.; L.A/C. G. F. Lewis, No. 103 Sqn.

These awards are given, in the main, for gallantry and devotion to duty by officers and N.C.Os attached to the A.A.S.F. before the evacuation of France and Flanders.

One of the squadron leaders in the list was engaged in the bombing of batteries in the vicinity of Calais and in the dropping of munitions and water to the garrison holding the Citadel there. Another officer similarly decorated was engaged in the same work. He led a formation of aircraft on a dive-bombing raid on a heavy battery position near Calais, and later by a skilful low approach at dawn he succeeded in dropping supplies to the beleaguered garrison exactly over the exceedingly small target without any loss to his formation. Again the same day he performed a similar feat, this in spite of the fact that neither he nor any of the crews in his formation had any previous experience in flying against the enemy.

The N.C.Os rendered fine service as members of air crews, chiefly as wireless operators/air gunners. Of one it is stated: "His devotion to duty in directing his pilot against strong opposition has been responsible for the safe return of his aircraft."

The citation in another case reads: "This air gunner has twice been a member of a crew forced to land by enemy action, and has on both occasions been full of enthusiasm to continue his tasks after returning to his unit."

Units named are those to which the officers and N.C.Os were attached when the decorations were earned.

Roll of Honour

AIR MINISTRY CASUALTY COMMUNIQUE No. 51.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed.

KILLED IN ACTION (WHILE FLYING IN OPERATIONS AGAINST THE ENEMY).—Sgt. L. F. P. Adlam, 745662; Sgt. L. C. Allton, 745436; P/O. R. Atkinson, 79530; Sqn. Ldr. G. R. H. Black, 37373; P/O. E. H. Brown, 41550; Sgt. N. Brumby, 742228; Sgt. M. G. Caryll-Tilkin, 902238; Sgt. J. J. Caswell, 581374; P/O. W. H. Clemerson, 81027; P/O. K. Cooney, 81678; Sgt. E. Davies, 553877; P/O. R. J. Davies, 42593; Sgt. H. Day, 742008; P/O. R. B. Dewey, 42815; P/O. R. J. Dickinson, 79372; F/O. J. F. Drummond, D.F.C., 40810; Sgt. V. C. Durrant, 564827; Sgt. R. M. C. Edwards, 746959; Sgt. S. A. Fennemore, 745110; P/O. E. C. Gardner, 72558; P/O. P. S. Gunning, 43474; Sgt. A. A. Heaneay, 756717; Sgt. W. H. Hewitt, 622581; Sgt. B. L. Henry, 551737; P/O. N. B. Heywood, 41923; Sgt. P. R. C. McIntosh, 745004; Sgt. J. P. Morrison, 754728; P/O. T. R. Murfitt, 42759; Sgt. A. B. Nayler, 553802; Sgt. D. Neill, 976437, Sgt. L. P. Neville, 901776; P/O. H. W. Reilley, 43043; Flt. Lt. F. C. Scott, 34055; Sgt. E. E. Shepperd, 566529; F/O. P. C. B. St. John, 40320; Sgt. A. F. Thomas, 521431; P/O. W. S. Williams, 42173; Sgt. D. R. Wright, 741930.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED IN ACTION," NOW PRESUMED "KILLED IN ACTION."—A/C.2 H. G. Ablett, 626935; P/O. F. E. Barber, 36223; P/O. J. P. Chester-Master, 76006; Sgt. W. L. MacDonald, 580877; A/C.2 R. C. Peel, 629076; P/O D. H. Wardlaw, 40157; P/O. E. A. Wickenkamp, 41088.

PREVIOUSLY REPORTED "MISSING," NOW PRESUMED "KILLED IN ACTION."—A/C.1 J. Booth, 630373; Cpl. R. S. Bryson, 524310; L.A/C. L. Close, 548536; Sgt. N. C. Cotterell, 580948; L.A/C. E. A. S. Haynes, 610705; L.A/C. J. B. Roberts, 541978; Act. Flt. Lt. K. R. Rogers, 39473; P/O. J. G. C. Salmond, 33476; Sgt. B. D. Shepperson, 561926; F/O. A. F. Smith, 39346; Cpl. H. Todd, 539657; Sgt. W. G. F. Whiting, 581252; Sgt. W. G. J. Wilkinson, 546143; Sgt. E. H. Williams, 580927.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED IN ACTION," NOW REPORTED "KILLED IN ACTION."—F/O. D. N. Grice, 70266.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "KILLED IN ACTION."—P/O. S. R. Bevan-John, 81933; Act. Flt. Lt. K. McL. Gillies, 37799; P/O. W. D. Hermon, 42708; Sgt. S. Macguire, 747938; Sgt. A. H. Payne, 566401; Sgt. W. G. Silver, 563391; Sgt. D. Sinclair, 744969; Sgt. J. C. Williams, 642147.

WOUNDED OR INJURED IN ACTION.—Sgt. F. H. Bevan, 740720; P/O. E. Bingham, 77926; Sqn. Ldr. H. P. Broad, 26174; Sgt. M. Connell, 629726; Sgt. R. W. Coutts, 746943; P/O. R. F. T. Doe, 41908; Sgt. C. S. C. Green, 747715; Sgt. R. C. Halstead, 754456; Sgt. C. G. Hilken, 745482; Sgt. W. R. E. Jarrett, 561763; Sgt. T. B. Kirk, 808416; Sgt. R. E. Langfield, 614301; P/O. T. E. Lee, 43162; F/O. P. W. Lefevre, 40719; P/O. J. S. Morton, 90727; P/O. L. C. Murch, 41946; Sgt. D. H. Nichols, 754158; F/O. W. B. Parker, 36259; P/O. P. D. Pool, 83281; P/O. J. Redman, 41952; P/O. J. K. Ross, 79163; Act. Flt. Lt. J. M. Strickland, D.F.C., 39581; Sgt. P. Thorpe, 754556; Sgt. A. S. Wilson, 624190.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. C. A. H. Ayling, 561455; Sgt. D. Flanagan, 532927; Sgt. E. T. G. Frith, 742091.

"MISSING," BELIEVED "KILLED IN ACTION."—P/O. G. P. W. Austin, 77130; P/O. J. E. Bartlett, 78994, Sqn. Ldr. J. O. Hinks, 36014; A/C.2 A. Jackson, 1050666; Sgt. E. Nield, 968346; Sgt. A. E. Skidmore, 742236; Sgt. O. K. Sly, 759093; Sgt. R. E. Stevens, 742992; Sgt. F. F. Vinyard, 748089; Flt. Sgt. E. E. Williams, 562960.

MISSING.—A/C.1 R. F. Abrams, 621850; P/O. J. G. I. Acheson, 74322; A/C.1 E. T. Arnott, 532387; A/C.1 P. O. Beckington, 901322; Sgt. R. G. Bennett, 969978; A/C.2 J. R. Best, 749226; Sgt. J. H. Brown, 742961; Sgt. A. W. Campbell, 545658; Sgt. P. T. Catto, 758161; A/C.1 R. Cleary, 631845; P/O. G. A. Cockayne, 41779; Sgt. F. Corbett, 618707; Act. Flt. Lt. E. L. Cullimore, 39860; P/O. R. G. Cuthbert, 41260; Sgt. K. McN. Davidson, 966854; P/O. J. L. De Keyser, 79166; L.A/C. A. J. Donaghy, 544946; Sgt. E. Duffield, 546967; Sgt. L. A. Dyke, 754831; Sgt. J. T. Farlowe, 755909; Sgt. J. A. Ferguson, 645352; Sgt. T. A. Ferris, 566370; Sgt. K. C.

SERVICE AVIATION (CONTINUED)

FULL MARKS: A three-quarter front view of the Rolls Royce Merlin-engined Fairey Fulmar. Points which may be noted from this photograph are the gun ports in the leading edge, the ejector exhausts, the catapult launching trolley attachments under the fuselage and the inward retracting undercarriage.

Friend, 747724; P/O. R. G. Furness, 74673; P/O. S. R. Gane, 42117; Sgt. R. E. Garstin, 616246; Cpl. J. P. Gavins, 512854; Sgt. D. B. Gordon, 740682; Sgt. H. F. Green, 742028; P/O. M. D. Green, 78363; P/O. R. A. Hanks, 42706; Sgt. C. W. Hartop, 741985; A/C.2 W. M. Higgins, 972371; P/O. E. E. Hives, 81354; Sgt. G. Holliday, 936348; Sgt. D. S. Imber, 748039; Sgt. B. D. Jones, 755459; Sgt. E. Jones, 546188; L.A/C. D. G. Kemp, 535214; Sgt. W. Kent, 518350; F/O. J. R. H. Lascelles, 41030; Sgt. W. A. Lofthouse, 751506; Sgt. F. G. R. McDonald, 936241; P/O. J. C. Mallon, 42719; Sgt. C. P. Mapplethorpe, 550436; Sgt. R. L. Milbourne, 652446; L.A/C. R. V. Minton, 536755; Flt. Lt. N. B. Mole, 37779; Flt. Sgt. W. T. G. Morman, 560125; Sgt. M. W. Neville, 742656; Sgt. A. S. Ogilvy, 754920; Sgt. F. P. O'Regan, 747713; Sgt. K. B. Parker, 742267; L.A/C. J. C. Perrie, 30039; Act. Flt. Lt. A. S. Phillips, D.F.C. 39153; Sgt. J. M. Purt, 553164; P/O. L. C. Quick, 42322; Sgt. E. A. G. Rands, 748785; Sgt. R. W. Reader, 548764; Sgt. M. Rees, 63714; Sgt. M. P. Reynolds, 747880; Sgt. R. F. Rose, 740263; F/O. A. T. Rose-Price, 39762; Flt. Lt. L. P. Rowley, 27146; Sgt. A. T. Shackleford, 613282; Sgt. J. E. R. Sharvin, 550430; Sgt. K. Shimells, 749466; L.A/C. M. E. Shirtliff, 969125; Sgt. D. A. J. Smith, 742822; Sgt. J. A. Smith, 741944; Sgt. J. Steel, 644325; Sgt. R. Stephens, 749413; Sgt. N. J. Stocks, 552636; Sgt. C. V. Stubbs, 745425; L.A/C. G. Swift, 551391; Sqn. Ldr. R. O. O. Taylor, 22092; P/O. D. E. Teden, 90486; Sgt. J. Tomlinson, 581125; Sgt. B. Walker, 581250; Sgt. H. Whelpton, 751267; Sgt. W. P. Whetton, D.F.M., 562350; Sgt. J. J. Wilks, 524023; Sgt. I. G. Wills, 969167; L.A/C. W. R. York, 549748; Sgt. R. G. Young, 580690.

"MISSING." BELIEVED "KILLED ON ACTIVE SERVICE."—Sgt. E. G. Greenwood, 754268; Sgt. F. Mills-Smith, 754054.

"KILLED ON ACTIVE SERVICE."—L.A/C. F. Alcock, 743201; Sgt. G. E. Ancliffe, 940153; Sgt. W. M. Batson, 625563; W/O. A. Berry, 286793; L.A/C. S. Blaylock, 542846; A/C.2. M. Blitz, 1155501; A.V.M. C. H. B. Blount, C.B., O.B.E., M.C.; A/C.1. A. B. D. Boylan, 966290; A/C.1. J. W. Colley, 640700; L.A/C. R. A. Coward, 1283302; P/O. D. P. Crittall, 41559; Sgt. E. E. Cryer, 754166; L.A/C. V. Davidson, 269024; Sgt. R. S. Eastment, 524673; Act. Flt. Lt. W. V. Emanuel, 75652; P/O. A. R. A. Forbes, 72989; A/C.1. R. J. M. Foster, 819119; P/O. C. C. M. Gauldie, 84029; P/O. G. Grant, 82108; Sgt. C. Hellewell, 935937; Sgt. S. J. Howard, 566350; Sgt. A. Hurst, 745670; P/O. P. R. S. Hurst, 41421; Flt. Lt. E. C. N. Jeffries, 15076; A/C.1. L. C. Kell, 901676; A/C.2. A. L. Mayo, 819009; A/C.2. E. Moore, 1117995; Sgt. P. F. Morris, 754457; P/O. W. S. Munday, 40637; Sgt. C. Murray, 553919; A/C.1. S. T. Nicholls, 819104; Sgt. D. E. O'Flaherty, 745075; Cpl. F. Orris, 846454; Sgt. I. F. Pearson, 745841; Sgt. R. Potter, 643788; A/C.2. A. C. Pottier, 1359646; A/C.1. G. M. Pring, 549818; P/O. C. W. A. H. Rafter, 41203; Cpl. A. H. K. Robertson, 550872; L/A.C. L. D. Rudling, 524247; F/O. P. D. Sharp, 72284; Sgt. M. S. Smith, 758154; P/O. F. E. Stronge, 79997; A/C.2. A. A. Summerfield, 819151; Sgt. S. R. Sumner, 748246; Sgt. T. N. Todd, 640677; F/O. T. D. Trouncer, 74264; L.A/C. F. G. Westlake, 157638; A/C.2. F. W. Wiggins, 1156226; L.A/C. W. J. Wynne-Harley, 515208.

PREVIOUSLY REPORTED "MISSING," BELIEVED "KILLED ON ACTIVE SERVICE," NOW PRESUMED "KILLED ON ACTIVE SERVICE."—Sgt. K. P. Vickery, 566236.

PREVIOUSLY REPORTED "MISSING" NOW PRESUMED "KILLED ON ACTIVE SERVICE."—Sgt. A. G. R. Allan, 562405; Sgt. R. Hawes, 565704; F/O. J. D. V. Porter, 39619.

PREVIOUSLY REPORTED "MISSING" BELIEVED "KILLED ON ACTIVE SERVICE," NOW REPORTED "KILLED ON ACTIVE SERVICE."—Sgt. J. Bishop, 754664; Sgt. S. Britnor, 754172; A/C.2 J. A. Jackson, 651960; P/O. W. E. King, 81356; Sgt. W. C. Munro, 755916.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. A. V. Aylott, 745550; Sgt. A. Baker, 565069; A/C.1 J. A. Barlow, 853748; A/C.2 J. W. Beaumont, 648950; A/C.1 L. Bond, 645539; Sgt. K. W. Bordycott, 755783; L.A/C. J. S. Bunbury, 1171396; Sgt. D. J. Capel, 759110; P/O. C. L. Elliott, 74970; L.A/C. E. E. Essex, 541134; A/C.2 J. T. Fletcher, 928469; P/O. D. V. Gilmour, 36240; L.A/C. C. F. Glover, 535512; A/C.2 R. H. Groom, 1250291; A/C.2 T. Keane, 1170137; A/C.2 J. H. Lee, 1185489; Sgt. G. R. Lyon, 970987; A/C.2. W. G. McAlpine, 1352428; L.A/C. E. McK. McCulloch, 966459; A/C.1 J. Massey, 656704; Sgt. F. R. Mills, 567958; Cpl. A. J. Moger, 545572; A/C.1 E. P. O'Donogue, 25427; Sgt. R. A. Powrie, 751073; Sgt. J. F. M. Reid, 535540; P/O. A. H. Simmonds, 39396; A/C.2 R. C. H. Smith, 1117944; P/O. R. Smith-Barry, 79522; Sgt. E. Swaine, 743292; A/C.2 F. D. Waines, 1007396; A/C.2 T. Ward, 1006157; A/C.2 W. J. Whyte, 1057438; A/C.2 S. J. Wood, 946329.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. K. N. Brown, 536877; A/C.1 W. L. Carver, 648341; Sgt. W. A. Dismore, 652610; L.A/C. L. J. Eaton, 572216; P/O. G. G. Elliot, 81730; A/C.2 K. A. Ferguson, 1057320; Sgt. A. J. Finch, 581444; A/C.2 F. H. Greening, 1260370; L.A/C. H. Heaton, 159142; Sgt. L. H. Hillelson, 745287; Act. W/O. E. G. Hunt, 359883;

ON TOP OF THE WORLD: An R.C.A.F. pilot receives his wings from Air-Commodore Johnson.

Cpl. B. J. Johnson, 550877; Sgt. J. F. F. Kerr, 148075; L.A/C. R. J. Mundy, 572493; A/C.1 H. Parrington, 903969.

DIED ON ACTIVE SERVICE.—P/O. Lord Alington, 83058; Wing Cdr. A. H. Allan, 10213; Cpl. F. H. Brown, 211243; L.A/C. W. R. L. Coombes, 614366; L.A/C. S. E. Devlin, 612253; A/C.2 J. H. T. Drake, 977686; Flt. Sgt. T. H. Drennen, 507735; A/C.1 P. McI. Dunn, 817115; A/C.1 A. J. Elson, 974223; L.A/C. R. Gooch, 621801; A/C.1 O. R. Lock, 941709; Cpl. J. W. Parker, 508774; L.A/C. C. F. Pickering, 13656; A/C.2 F. H. Pickering, 1358349; A/C.2 T. C. Piggott, 1150578; A/C.2 J. Shea, 1177116; A/C.2 K. V. Simpson, 964076; Act. F/O. N. G. Stewart-Dawson, 73933; A/C.2 J. Strong, 997481; L.A/C. P. Tomlinson, 567844; L.A/C. E. Wiffen, 571765.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "PRISONER OF WAR."—Sgt. G. Avery, 518279; P/O. R. S. A. Churchill, 41255; Sgt. G. W. Clawley, 533480; Sgt. G. H. Hatch, 510966; L.A/C. J. Hopkins, 358338; P/O. N. A. Savill, 41956; A/C.1 F. P. Steel, 900494; A/C.1 D. O. Tucker, 569789.

Royal New Zealand Air Force

KILLED IN ACTION.—Sgt. I. C. Scoular, N.Z.391870.

MISSING.—Sgt. C. H. Douglas, N.Z.391346.

KILLED ON ACTIVE SERVICE.—Sgt. G. W. Hunt, N.Z.39922.

Prisoners of War

THE following is the latest list of British prisoners of war as received from enemy sources:—

IN GERMAN HANDS.

Sgt. W. D. Chamberlain, St. Michael's Crescent, Pinner; L.A/C. J. Senior, Swanage, Dorset; Flt-Lt. A. A. Rumsey, Address Unknown; Sgt. E. J. Williams, Charrington Road, Cheadle; L.A/C. A. J. P. Dixon, Fallowfield, Manchester.

London Gazette

Royal Air Force

General Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Flight Sergeants: (Aug. 27, Sen. Aug. 26) G. Taylor; (Oct. 8, Sen. Aug. 26) W. J. Rye. Sergeants: (June 15, Sen. May 2) R. W. Pearson; (Sept. 26, Sen. April 25) R. J. Brown; (Sept. 27, Sen. Sept. 2) F. M. Osborn; (Oct. 5, Sen. May 16) T. J. Watkins; (Oct. 14, Sen. Oct. 9) M. M. Wallen-Stein.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation (June 23, 1940, Sen. June 4, 1940). (Substituted for notification of July 16, 1940, (p. 4361, col. 1)):—Sergeants: A. F. Chisholm, B. V. Manders.

P/O. on probation R. V. Whitehead is confirmed in his appointment and promoted to the rank of Flying Officer (Oct. 16).

The undermentioned Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers: (Aug. 24, Sen.

SERVICE AVIATION (CONTINUED)

April 20) P. Windram; (Aug. 31, Sen. April 20) R. E. M. Hughes-Chamberlain, E. N. Southwell; (Aug. 31) P. R. Mildren; (Sept. 29) P. G. H. Salmon.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant: (July 27) G. Harris, A. S. B. Blomfield; (Aug. 6) J. W. B. Vernon; (Aug. 17) J. F. Grey, P. N. Jennings; (Aug. 27) J. H. D. Chapple, P. D. J. Strong; (Sept. 3) D. B. Hobson, K. McL. Gillies, L. G. Schwab, P. G. Jameson, D.F.C., N. J. Starr, J. F. Sutton, D. J. How, W. P. Cambridge, V. Mitchell, L. F. Henstock, P. J. Emerton, C. R. Kelaher, P. H. Alington, J. Ellis, D.F.C., R. A. G. Morgan, D. O. Butler, I. P. Grant, C. D. Fox, S. F. Coutts-Wood, D.F.C., F. F. Lambert, J. H. Giles, L. G. Burnand, R. B. Smith, C. R. B. Wigfall, J. Martin, P. H. M. S. Hunt, D. H. Cross, J. S. Adams, D.F.C., T. D. B. Blake, P. M. Brothers, D.F.C., W. T. C. Seale, B. J. Thomas, E. C. Wolfe, J. M. Griffith-Jones, W. W. Campbell, D.F.C., S. C. Bastin, R. W. Christmas, B. O. Huxtable, J. E. Scoular, D.F.C., J. P. Hopkins, F. W. S. Turner, D. C. Stapleton, A.F.C., K. W. Kaufmann, W. B. Wight, A. C. Leggate, W. M. H. Brookes, R. S. Blake, C. E. Harris, C. S. Kemp, R. V. Evers-Swindell, C. G. S. Robinson, H. G. Marriott, G. R. N. H. Jan, J. E. R. Penhausen, H. C. Tootal, J. T. Bouwens, G. P. Westropp-Bennett, L. H. W. Parkin, S. E. A. Brown, C. D. Lavers, A. S. Phillips, D.F.C., B. T. Frogley, P. M. Wigg, L. D. Mayor, K. F. Mackie, P. R. A. Ellis, J. D. Stephens, K. W. Bonnar, P. E. B. Martin, P. G. O. Box, M. J. Earle, D. I. Fairbairn, D. L. R. Halliday, D.F.C., J. W. B. Davis, R. Baron, J. A. L. Fowler, W. J. Smith, C. A. Harris, B. Brooke, W. R. Williams, G. T. Palmer, T. M. Bulloch, R. F. Marrack, J. A. Piddington, A. H. Hannigan; (Sept. 15) C. W. Poulter; (Sept. 25) W. B. Keddy; (Oct. 15) W. P. Copinger, J. E. Carter; (Oct. 26) A. B. Lennie.

The undermentioned Pilot Officers are promoted to the rank of Flying Officers: (April 7, Sen. Jan. 7) M. H. C. Maxwell; (April 21, Sen. Jan. 21) E. A. H. Chapple; (June 29) G. V. Nicholls; (July 4) P. C. D. Eaton; (Aug. 17) P. M. Boulton, A. A. McD. Scott; (Aug. 22) D. G. Marshall; (Aug. 25) W. A. Wild, V. T. H. Frith, B. E. Peck, J. E. Gorringe-Smith, K. McI. Miller; (Aug. 29) R. A. Acworth, W. E. Bowden, L. L. Jones, D.F.C., T. O. O'Neill, C. E. L. Powell; (Sept. 3, Sen. Aug. 4) L. G. W. Lilly, W. S. Rea; (Sept. 31) M. S. Ferguson, H. B. Kirk, J. P. Michell, A. R. Butcher, R. O. Altmann, D.F.C., J. Wilson, R. S. Bohm, R. S. Jephson, N. T. Marix, L. M. Whetham, C. L. Roy, W. Surtees, W. S. Worner, R. H. C. Burwell, J. W. Appleton, D. F. H. Smith, J. Clift, N. G. Macfarlane, E. M. Mason, L. A. Wood, A. W. Horne, W. B.-B. H. Griffith, T. O. Walker, J. F. Painter, A. A. Campbell, L. J. D. Omissi, K. F. P. Bond, R. L. C. Axworthy, J. A. Carmichael, C. A. J. Macnamara, E. W. Murray, R. B. E. Duff, S. R. Peacock-Edwards, B. F. C. Houston, R. H. Bunker, D.F.C., J. F. Evans, R. J. Dunlop-MacKenzie, L. A. Scott, A. A. G. Trueman, W. C. Hoey, J. Woodroffe, E. P. Henley, R. W. Oxspring, E. F. Cawdery, J. Lewis, A. Webster, D.F.C., H. O. Forth, C. G. Chappell, C. R. Hattersley, D.F.C., R. T. Sturgess, E. R. Sutton, P. D. Smith, D.F.C., P. J. Dorrington, K. Bell, I. R. Gow, B. S. Jones, R. Bicknell, J. Waddingham, G. H. Bellamy, M. J. A. Shaw, R. Thompson, D. P. Massey, A. E. Bull, M. J. C. Harwood, A. R. Elliott, P. G. Scoby, G. Hollo-way, S. A. Hankey, T. F. C. Churcher, V. Hill, G. T. R. Johns, P. S. Devine, J. T. Strang, S. N. Johnson, M. J. Hunter, F. H. Long, D.F.C., A. M. Paape, J. A. Paterson, T. A. Stewart, M. C. Kinder, M. J. Berry, G. P. Watson, A. J. Grisenthwaite, A. J. Mackay, A. R. Dunn, A. N. Constantine.

P/O. H. W. Lamond is promoted to the rank of Flying Officer (Sept 3, Sen. Aug. 4).

Wing Cdr. J. G. Hawtrey is seconded for Special Duty (Sept. 30).

Group Capt. S. D. Culley, D.S.O., ceases to be seconded for Special Duty (Oct. 1).

The undermentioned are transferred to the Technical Branch (April 24):—Group Captain (temporary): D. H. De Burgh, A.F.C. Wing Commander: C. K. Chandler, M.B.E. Squadron Leaders: J. R. D. Goadsby, R. L. Phillips, W. C. Cooper, G. H. Foss, B. A. S. Lewin (ret.), C. E. Hartley.

The undermentioned Pilot Officers relinquish their temporary commissions on return to Army duty: (Sept. 27) R. T. A. Burton, 2nd Lt., Devon R.; (Sept. 30) P. P. Danson, 2nd Lt., R.A.

F/O. S. C. Holbrow relinquishes his short service commission on account of ill-health (Oct. 24).

The short service commission of Act. P/O. on probation A. A. Vanderwater is terminated on cessation of duty (Oct. 1).

Technical Branch.

Sqn. Ldr. C. E. Hartley is promoted to the rank of Wing Commander (temp.) (Sept. 1).

Erratum.

Notification of Oct. 29 concerning Sgt. P. C. Mortimore and Cpl. A. E. Jaquemet should have appeared under the heading R.A.F.V.R. instead of R.A.F.

Balloon Branch.

The undermentioned are granted commissions for duration of hostilities as Pilot Officers on probation:—Warrant Officer: (Oct. 12, Sen. Sept. 27) W. McQ. Pratt; Sergeant: (Sept. 17, Sen. Sept. 5) C. F. Norris.

Administrative and Special Duties Branch.

The undermentioned are granted commissions for the duration of hostilities:—As Flying Officers on probation. Warrant Officers: (Oct. 4, Sen. Aug. 20) A. Peyton; (Oct. 7, Sen. Apr. 25) S. L. West; (Oct. 10, Sen. Apr. 25) J. S. C. Bannerman, M.C.; (Oct. 19, Sen. Oct. 1) L. W. Curtis. As Pilot Officers on probation:—Warrant Officer: (Oct. 18, Sen. Sept. 13) A. B. Scott. Flight Sergeant (Aug. 17, Sen. July 25) J. S. Orr. Corporal (Oct. 15, Sen. Aug. 30) E. D. Anderson. Leading Aircraftman (Oct. 15, Sen. Aug. 30) R. B. Watkins. As Acting Pilot Officers on probation:—Flight Sergeant: (Sept. 27, Sen. Aug. 19) H. O. Jones. Sergeant (Oct. 17, Sen. Sept. 5) V. A. Nicholls.

The commissions of the undermentioned are terminated on cessation of duty:—(Sept. 2) Flying Officer on probation W. C. Cox; (Oct. 17) Pilot Officer on probation A. T. Hardy.

Equipment Branch.

The undermentioned Pilot Officers on probation are confirmed in their appointments May 1, 1940, and promoted to the rank of Flying Officer:—(Aug. 25) B. P. Harper, E. I. Lee.

The undermentioned Pilot Officers on probation are confirmed in their appointments (Aug. 17), and promoted to the rank of Flying Officer:—(Sept. 14) P. Prince; (Oct. 12) J. W. Mackay; (Oct. 14) D. E. Allsopp; (Oct. 31) P. G. Tyler.

F/O. W. P. Williams, A.F.M., is promoted to the rank of Flight Lieutenant (Sept. 4).

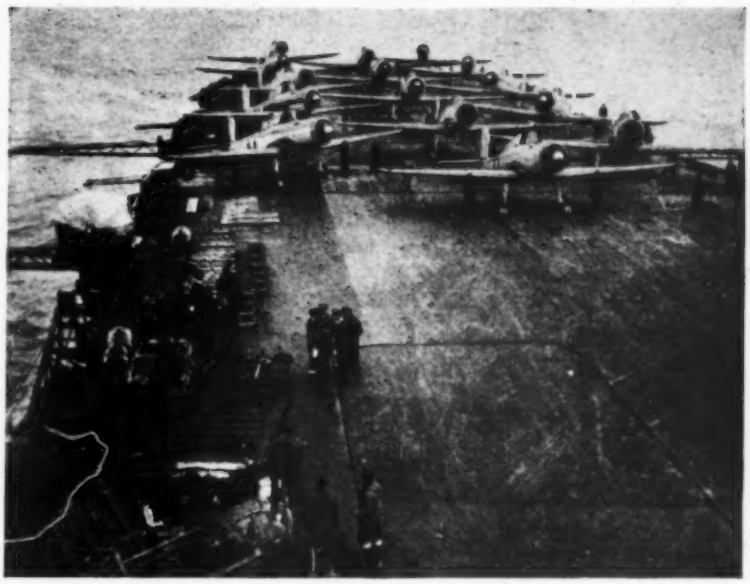
The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(Oct. 14) F. N. Baird, F. F. Baker, W. M. Dallas, J. H. Granville Brown; (Oct. 31) F. C. Walker.

Sqn. Ldr. F. Petch, O.B.E. (ret.), takes rank and precedence as if his appointment as Squadron Leader bore date Aug. 16. Reduction to take effect from Aug. 16.

Accountant Branch.

Flt. Sgt. J. L. Sefton is granted a commission for the duration of hostilities as Acting Pilot Officer on probation (Oct. 12, Sen. Sept. 18).

The undermentioned Pilot Officers on probation are confirmed in their appointments (July 29), and promoted to the rank of Flying Officer:—(Sept. 7) W. G. Morgan; (Sept. 18) F. G. Turner.



ENGLAND'S DIVE BOMBERS: Fifteen Blackburn Skuas with engines ticking over waiting for the take-off signal. Note the ship's radio aerial masts at right angles to the deck and the multiple pom-pom in the foreground.

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS.

General Duties Branch.

Wing Cdr. C. J. R. Turner is granted the rank of Group Captain (July 15).

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(Sept. 3) H. D. Ripley, E. Fulford, C. E. F. Arthur, A. J. Edmunds, L. J. Dixon, B. S. Smallman, D. Kinnear, P. Cannam, N. G. F. Rose, P. J. Field-Richards, P. A. Simpson, W. W. L. Jones, D. M. Tomlinson, L. F. Payne, H. L. Price, J. S. Danby; (Sept. 25) E. T. Scott.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(July 17) C. F. L. Wilcock; (Sept. 3) H. Garnell.

Flt. Lt. D. R. Chance is transferred to the Administrative and Special Duties Branch (Oct. 10).

The undermentioned relinquish their commissions in class CC on appointment to commissions in the R.A.F.V.R.:—(Oct. 10) Group Capt. C. J. R. Turner, F/O. E. Taylor; (Oct. 21) Flt. Lt. K. W. Wilkins.

ROYAL AIR FORCE VOLUNTEER RESERVE.

General Duties Branch.

The undermentioned are granted commissions for the duration of hostilities:—As Pilot Officers on probation: (Sept. 20) J. P. Kennedy; (Oct. 7) J. R. Stebbing; (Oct. 11) C. B. Wilson; (Oct. 14) D. H. Gittins. Sergeants: (June 5) J. H. H. Luxton; (June 18) S. J. Madle; (Aug. 10, Sen. Aug. 4) R. F. Keighley; (Aug. 10) R. Wareing; (Aug. 17) M. H. Clive; (Aug. 31, Sen. Aug. 24) K. G. Kitto; (Aug. 31) P. A. Harris, P. G. Leggett, J. S. Towsey; (Sept. 7) P. A. Baillon, F. H. R. Baraldi, G. D. Calderhead, E. G. Titley, J. P. Eyre, T. W. Ward; (Sept. 14, Sen. Sept. 7) A. M. Rusk; (Sept. 14) R. G. W. Beveridge, D. J. Renvoize, R. Scott, B. P. Klee, J. A. Lyddiard; (Sept. 21, Sen. Sept. 14) G. H. Batchelor, C. Colebrook, A. R. Tidman; (Sept. 22, Sen. Sept. 21) M. Briggs, J. G. Pippet, K. H. Rowlands, B. E. Tucker; (Sept. 22) W. Brown, J. G. Simpson, B. H. Tweedale, C. D. A. Neill, I. D. N. Lawson, J. A. Jourdain, A. J. Oliver, J. H. Loder; (Sept. 23) A. S. Lucas; (Sept. 26, Sen. Sept. 25) H. J. Akroyd; (Sept. 28, Sen. Sept. 22) T. R. Poynton, H. A. B. Simons, D. C. Fyfe, W. E. Tym; (Sept. 29, Sen. Sept. 22) S. G. H. Fawkes, N. H. Goodall, J. E. I. Grey, R. A. Johnston, P. W. E. Heppell; (Sept. 29) J. A. J. Bailey, C. P. Lupton, F. T. Reynolds, G. W. Hodgson, D. McI. G. Robertson, J. A. Atkinson, G. E. Musgrove, D. C. Brown; (Oct. 1, Sen. Sept. 25) F. S. Gonsalves, J. H. A. Wells; (Oct. 2, Sen. Aug. 14) S. A. L. Tarlton; (Oct. 2, Sen. Sept. 29) G. May, J. E. King; (Oct. 5, Sen. Sept. 29) F. Finney, D. Iveson, J. Keegan, J. L. Milner; (Oct. 5) J. Turner, J. G. Rogers, G. W. Curry, W. M. Dixon, J. R. L. Dunn, C. D. Waldron, J. F. W. Elliott, G. M. Fairbairn, W. J. Rees, W. K. Stobbs, F. H. J. Ashley, A. V. Duffill; (Oct. 6, Sen. Sept. 29) H. E. Penketh, F. S. Roberts; (Oct. 6) J. H. Mackinder, S. J. Thompson, P. D. White, D. S. F. Winsland, R. G. Wyatt, F. P. Ferris, P. W. Jeffrey, D. C. Tufnell; (Oct. 9, Sen. Oct. 5) A. Da Costa, F. W. Fairweather; (Oct. 9, Sen. Oct. 6) L. S. Heath; (Oct. 12) H. C. Langford, M. Lissner, J. R. Scott, N. Howkins; (Oct. 16, Sen. Oct. 14) R. M. Chatfield, R. David; (Oct. 18, Sen. Aug. 15) E. M. Shannon. Acting Corporals:—(Sept. 6) R. G. G. M. Marsden; (Sept. 22) P. A. Bitmead, G. E. Sharvell. Leading Aircraftmen:—(Sept. 8) E. J. Dickie, R. T. Hewer, N. S. Miller, P. I. W. Pemberton, G. E. Fowler; (Sept. 22) H. H. Mountain, J. H. Robinson, K. Ross, P. A. Goodwyn; (Sept. 29) W. A. S. Bleckden. As Acting Pilot Officers on probation:—(June 27) C. S. B. Montagu; (Oct. 11) E. F. Waters; (Oct. 14) F. J. Pidgeon; (Oct. 16) A. C. Fairtlough.

Act. P/O. on probation P. L. Scott is graded as Pilot Officer on probation (Sept. 14).

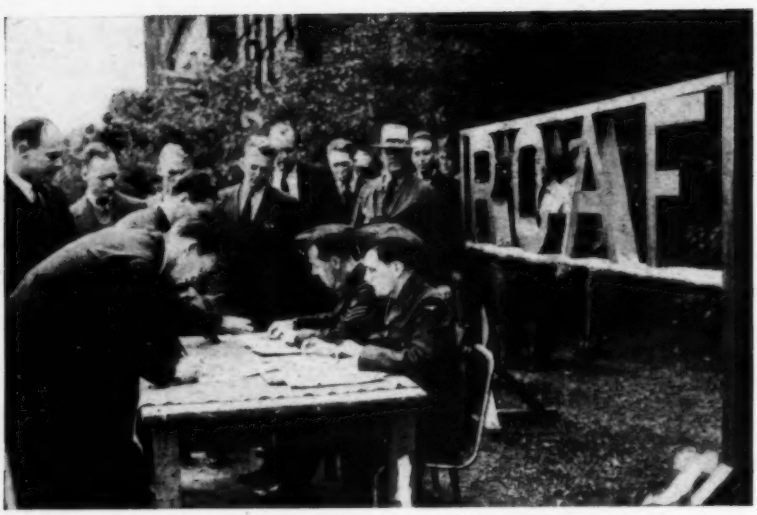
The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(Sept. 3) N. D. B. Wood, R. de W. K. Winlaw.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(Sept. 3) D. G. Jehpson, D. A. Cracknell, E. J. Martin, A. R. A. Forbes, K. N. T. Lee, The Hon. D. A. Coke, R. C. Chopping; (Sept. 4) H. R. Bjelke-Petersen; (Sept. 23) R. H. J. Mountford; (Sept. 25) H. M. Newton, A. F. A. Osborn; (Sept. 26) G. E. Milnes, L. R. de M. Thompson, E. J. A. Williams; (Oct. 10) H. W. S. Adams.

The undermentioned are transferred to the Administrative and Special Duties Branch:—Pilot Officer: (July 12) C. S. Watkinson. Pilot Officers on probation: (Oct. 10) I. C. Rushton; (Oct. 23) S. D. B. Montgomery; (Oct. 26) A. W. C. Butler.

Technical Branch.

P/O. on probation C. S. Jones is confirmed in his appointment (Sept. 28).



UP THE EAGLES: A considerable number of Americans, including some experienced pilots, have crossed the border and signed on with the Royal Canadian Air Force. The photograph shows a typical scene at a border recruiting station.

Balloon Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—(Sept. 24) G. A. V. Staples. Sergeant: (Oct. 12 Sen. Sept. 27) H. Double. Corporals: (Aug. 3, Sen. July 29) A. B. H. Reed; (Oct. 12, Sen. Sept. 27) T. Craig; (Oct. 16, Sen. Sept. 30) L. R. Rust. Leading Aircraftmen: (Sept. 17, Sen. Sept. 5) K. S. Matthews; (Oct. 17, Sen. Oct. 1) R. Hall. Aircraftmen 1st Class: (Sept. 13, Sen. June 25) R. Fortuyn-Droogleever; (Sept. 17, Sen. Sept. 5) D. A. Yeoman; (Sept. 21, Sen. Aug. 28) C. A. Wiard; (Sept. 29, Sen. Sept. 12) L. H. Cooke.

L.A/C. C. L. D. Guy is granted a commission as Pilot Officer on probation (July 15, Sen. June 27).

The undermentioned Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer:—(Sept. 3) J. W. Ellis; (Sept. 5) A. D. Proudfoot, A. D. Fyfe; (Sept. 19) G. R. Powell.

The undermentioned Pilot Officers on probation are confirmed in their appointments:—(Sept. 3) R. Walker; (Sept. 5) J. H. King.

Administrative and Special Duties Branch.

Lt.-Col. C. J. R. Turner is granted a commission as Wing Commander (Oct. 10, Sen. April 5, 1939).

Major K. W. Wilkins is granted a commission as Flight Lieutenant (Oct. 21).

A. McC. Goddard is granted a commission for the duration of hostilities as Flight Lieutenant (Sept. 11).

P/O. A. D. Evans, Southern Rhodesian Air Force, is granted a commission for the duration of hostilities in his present rank (Oct. 1).

The undermentioned are granted commissions for the duration of hostilities:—As Flying Officer: (Sept. 24, Sen. Sept. 1) J. E. M. Atherley. As Pilot Officers on probation: (June 17) G. Cook, T. K. Twist; (June 18) F. T. Bamber; (June 20) L. G. P. Moore; (June 22) G. L. Reay; (June 24) J. L. Byrne, S. O. Crowther, J. T. Ellis, N. E. Gladwell; (June 26) B. M. Newton; (June 27) G. M. Withers; (June 28) H. C. Kirsopp; (July 1) Sir M. R. H. Crofton, D.S.O., W. J. W. Atty, G. G. Gilbert-Green, M.B.E., H. Metcalf, R. A. Wade; (July 3) H. Allen, D.S.O., W. A. Lewis, E. A. Moore; (July 8) G. W. P. Dawes, D.S.O., A.F.C.; (July 11) C. F. Adams; (Aug. 12) A. D'A. Anderson; (Aug. 16) T. H. Cotton (Aug. 22) L. P. Ball; (Aug. 23) H. G. Bentley; (Aug. 27) R. G. Carr; (Sept. 6) W. U. Wray; (Sept. 12) R. C. Mais; (Sept. 14) J. C. Mitton; (Sept. 20) E. O. Bruce, G. M. Lloyd; (Sept. 21) J. D. Gunnis; (Sept 22) P. B. Snoaden; (Sept. 23) H. E. G. Browning; (Sept. 25) T. E. Hughes; (Sept. 26) B. H. Morgans, F. G. Oakley, N. W. B. B. Thoms, C.B.E., D.S.O., M.C., W. G. Williams; (Sept. 27) H. A. Chinai; (Sept. 30) E. Hardcastle, B. Newton John; (Oct. 1) D. H. Clifford, C. Wedgwood; (Oct. 2) G. B. Graham; (Oct. 3) J. Baines, R. K. Black; (Oct. 4) L. G. Cullen, A. M. Jamieson, J. Turner, D.F.C., G. Westray; (Oct. 5) H. L. Birley, P. A. Coates, G. Dutton, G. D. Hanson, C. F. C. Holmes, L. P. Robinson; (Oct. 6) L. Parry; (Oct. 7) J. C. F. Gundry, H. O. Thorp, A. Tout, A. S. Woods, E. A. Sorrell; (Oct. 9) R. E. Evans, F. Hobson, D. A. Owen, F. R. Robinson, F. H. Thompson, E. W. Walls; (Oct. 10) D. F. Cave, H. J. Fisher, M.C., A. J. Howard, O. T. Jones, M.C., B. B. King, H. H. Peters, C. T. Rowan, J. W. G. Snook; (Oct. 11) F. Arnott, D. Cook, D. A. H. Mansell, W. H. Nicholson, E. G. Rumfitt, T. I. Simpson, F. J. A. Towsey, E. C. A. Wing; (Oct. 12) J. F. Falconer, D.S.O., M.C., P. G. Tennant; (Oct. 14) R. P. Adler, W. E. Blake, C. F. Butcher, D. L. Coutts, R. Cusack, J. Dalal, J. E. Foster, C. F. Ingle, D. E. Michaelson, J. S. W. Murray, F. B. Tempest, F. G. Wall, A. H. Waters, J. M. Andrew, W. A. Green; (Oct. 16) G. A. Firth, F. J. Hartland, M. E. B. Lambert, R. Ogle, I. R. Purdie, E. G. B. Relf. Sergeants: (Oct. 12, Sen. Sept. 16) J. Thackeray; (Oct. 15, Sen. Oct. 4) G. T. Harrison. Aircraftman 1st Class: (Sept. 27, Sen. Aug. 16) R. J. Knight. As Acting Pilot Officers on probation:—Corporal: (Oct. 18, Sen. Sept. 23) N. T. Helme. Aircraftman 1st Class: (Aug. 21, Sen. July 22) E. J. L. Rengert.

D. S. Lawrence is granted a commission for the duration of hostilities as Pilot Officer on probation (Aug. 21).

The undermentioned Pilot Officers on probation are confirmed in their appointments:—(Sept. 3) C. H. Sleightholme; (Sept. 9) H. B. Bell, E. G. Brant, B. F. S. Irwin, C. E. Turner, G. F. Ward; (Sept. 19) R. J. Hulburd, F. K. Langton, C. W. T. MacGillivray, C. E. Prescott, J. C. Richmond, F. F. Walter; (Sept. 20) K. S. Innes; (Sept. 26) H. D. Benham, J. R. S. Borman, A. C. Clark, L. R. Evershed; (Oct. 4) W. H. R. Reader; (Oct. 10) M. H. Frame, B. A. Levey, B. L. Bathurst; (Oct. 11) R. F. Potter; (Oct. 12) E. L. Fuller, E. M. Malone, W. L. Stewart; (Oct. 14) K. P. Atkinson, M.C.; (Oct. 17) H. A. Daniell, O.B.E., L. H. F. Irving, J. K. Silver; (Oct. 19) R Law; (Oct. 20) J. L. Luntley, B. Drewe.

P/O. on probation C. C. Danvers is confirmed in his appointment (Oct. 6) and promoted to the rank of Flying Officer (Oct. 12).

The undermentioned Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer:—(Sept. 5) W. Lee, D. H. Lees; (Sept. 9) C. S. Dawson; (Sept. 19) C. B. Pinnock; (Sept. 26) E. Fletcher, H. Rodger; (Oct. 5) P. A. Harding, C. H. Smith; (Oct. 9) G. Salaman; (Oct. 10) A. V. Randall, E. H. Mallia.

Hon. F/O. C. F. Cunningham-Jardine is granted the Hon. rank of Flt.-Lt. (Oct. 1).

The undermentioned Hon. Pilot Officers are granted the Hon. rank of Flying Officer (Oct. 1): J. W. D. Rowlandson, C. H. Spencer.

The undermentioned are transferred to the General Duties Branch:—(Aug. 15) F/O. E. H. Irving; (Oct. 3) P/O. on probation R. Kronfeld.

The undermentioned are transferred to the Technical Branch:—(Apr. 24) F/O. C. O. Hinks; (Sept. 3) F/O. E. D. Drew.

Sqn. Ldr. R. W. Brierley relinquishes his commission (Oct. 26).

P/O. on probation H. Clayton-Wright relinquishes his commission on account of ill-health (Oct. 22).

The undermentioned Pilot Officers on probation resign their commissions:—(Oct. 5) J. E. A. Binnie; (Oct. 30) W. T. Benfield.

The commissions of the undermentioned Pilot Officers on probation are terminated on cessation of duty:—(Sept. 16) H. R. Heelay; (Sept. 18) F. Waterhouse; (Sept. 24) H. E. Blalberg; (Sept. 26) A. R. L. Knight; (Sept. 28) T. de B. Carey; (Oct. 10) H. C. V. Porter; (Oct. 17) B. H. S. Stephenson; (Oct. 20) O. M. Parker; (Oct. 22) A. Hood, G. V. Williams; (Oct. 23) L. A. R. Kemp; (Oct. 24) C. R. Campbell.

Meteorological Branch.

The undermentioned Pilot Officers on probation are confirmed in their appointments:—(Aug 1) A. E. Chapman, L. S. Bill, W. J. Elliott, R. A. Fleming, A. V. Hardy, J. E. Walsh.

Equipment Branch.

The undermentioned Act. Pilot Officers on probation are graded as Pilot Officers on probation:—(Sept. 17) C. L. Ashford, A. Barron; (Sept. 27) D. M. Tyringham, R. Beckton, R. A. Abbot, L. P. Alexander, F. K. Axten, R. A. Bates, R. T. Berger, V. R. D. Borman, H. B. Brailsford, B. S. Bridges, J. G. Bridges, A. T. Bristow, W. P. Bryden, J. A. Burdett, R. Burton-Fanning, R. L. Butland, D. H. S. Cameron, E. C. Carline, C. D. Carter, J. G. H. Carter, P. E. N. Catchpole, H. W. Clark, H. Cranston, C. F. Crosby, A. W. Cunliffe, P. L. G. Daniell, L. A. Davies, H. B. Deane, C. H. Dennis, E. F. Doel, T. A. Douglas, E. W. Downing, G. A. Dunkels, E. S. Eatherley, C. L. Elliott, W. P. Elliott, C. E. Ellis, J. P. Erskdale, A. W. Giggins, W. A. Harris, B. H. Hillman, D. C. Horth, E. A. Hubble, A. E. Hunt, G. V. Isaacs, A. F. Jackson, G. W. Jones, H. C. Kemp, J. E. Kidd, S. C. McIntyre, D. C. A. McPherson, M. Mead, J. Moffett, H. S. Murphy, D. C. M. Oliver, V. de B. W. Owen, O. F. Owens, H. Palmer, W. C. Phelps, H. W. Read, E. A. Samuel, V. G. Scholefield, A. C. Sharpe, J. A. Shaw, W. A. Slinn, G. M. Sparrow, G. F. Speight, A. L. Steele, G. F. Stevens, R. G. Stevenson, J. W. Studdert, M. F. Sutton, E. G. Tate, E. L. Taylor, M. A. T. Taylor, E. A. Thomas, W. Thompson-Hughes, J. F. B. Tigg, C. S. Titcombe, J. B. Townsend, G. H. Vince, T. H. D. Wall, L. H. Whitlamsmith, K. G. Williamson, H. Wright; (Sept. 28) W. P. Campbell.

Accountant Branch.

The undermentioned are granted commissions for the duration of hostilities as Act. Pilot Officers on probation:—(Oct. 12) T. C. Arnot, C. H. R. Bassett, J. H. Buckton, R. E. Darrah, R. L. Davies, W. H. G. Dearnley, J. W. McI. Gillieson, F. G. Hawkes, E. R. Hedgecoe, I. L. Ingram, E. V. Lyell, W. J. McLaughlin, J. A. W. T. Morgan, W. G. Nicholson, C. Thomas, E. S. Townsend, L. A. Wigzell, L. H. Willetts, T. Wilson, H. Winterbottom, C. W. Wyatt, J. F. D. Yerbury. Leading Aircraftmen: (Sen. Sept. 18) H. H. V. Ellis; (Sen. Aug. 13) H. A. Walker. Aircraftemen 1st Class: (Sen. Sept. 18) A. C. Shay.

Medical Branch.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(Sept. 18) D. D. Reid, M.B. Ch.B.; (Oct. 17) J. R. Caldwell, M.B., B.Sc., M.R.C.S., L.R.C.P.

Dental Branch.

D. A. Fairfax, L.D.S., is granted a commission for the duration of hostilities as Flying Officer (Oct. 15).

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(Sept. 22) P. D. Law, L.D.S., R.C.S.; (Sept. 25) M. R. Cable, B.D.S., D.D.S.; (Oct. 2) C. E. Maguire, L.D.S., R.C.S.; (Oct. 9) D. F. Mace, L.D.S., A. Rand, L.D.S.; (Oct. 10) G. S. W. Willis, L.D.S.; (Oct. 16) C. V. Kark, L.D.S., D.M.D., K. W. Laws, B.D.S., D.M.D.

Chaplains Branch.

The undermentioned are granted commissions for the duration of hostilities with the relative rank of Squadron Leader:—(Oct. 16) The Rev. A. J. Pearman; (Oct. 21) The Rev. P. K. Challen, The Rev. E. T. Doig, The Rev. S. Groves, The Rev. J. W. Mayer.

Auxiliary Air Force

General Duties.

Act. P/O. on probation H. G. Niven is confirmed in his appointment and graded as Pilot Officer (Aug. 17).

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(Sept. 3) J. C. Reynolds, E. B. B. Smith, D.F.C., A. H. Rook, C. R. Elgar; (Oct. 25) P. G. Lamb.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(Sept. 3) A. J. Blayney, W. W. Straight, B. G. W. L. J. Allerton.

Technical Branch.

P/O. A. J. Jones relinquishes his commission on account of ill-health (Nov. 5).

Balloon Branch.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(Sept. 3) W. E. Ballard, C. E. Simons, W. J. S. Mills, S. H. Holland, F. M. Hardy, A. H. P. Noel, A. W. Dent, C. H. F. Palser, H. P. Davies, D. H. Courtenay, E. H. Colley, R. T. Owen.

Administrative and Special Duties Branch.

P/O. R. J. Kilby is promoted to the rank of Flying Officer (Sept 11, 1939).

Auxiliary Air Force Reserve of Officers

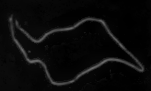
General Duties Branch.

F/O. J. R. T. Bradford is promoted to the rank of Flight Lieutenant (Sept 3).

Women's Auxiliary Air Force

The undermentioned are appointed Assistant Section Officers:—(Oct. 26) A/CW.2 Miss P. A. Carver, A/CW.2 Miss J. Dodson, A/CW.2 Miss L. Dore, A/CW.2 Miss J. M. Drummond-Smith, A/CW.2 Miss E. Harding, A/CW.2 Miss E. Hare, A/CW.2 Mrs. J. M. Heron, A/CW.2 Miss M. E. Hunter, A/CW.2 Miss B. P. Perkins, A/CW.2 Miss A. V. Staples, A/CW.2 Mrs. A. K. Walmsley; (Oct. 27) Sgt. Mrs. D. M. Apperley, Cpl. Miss I. J. Briggs, Sgt. Mrs. A. L. Clark, A/CW.2 Mrs. E. W. Gilliam, A/CW.2 Miss E. A. M. Hagerty, Cpl. Miss M. Lane, Cpl. Miss P. L. Pocklington, A/CW.2 Mrs. L. M. Russell-Andrews, A/CW.2 Mrs. S. R. Taylor, Cpl. Mrs. L. M. Teal.

Assistant Section Officer Miss E. J. Stevens relinquishes her appointment (Oct. 23).

Flt. Officer Mrs. K. M. Ryan relinquishes her appointment on account of ill-health (Oct. 28).

SERVICE AVIATION (CONTINUED)